

DRAGON USER

A stylized red dragon logo with wings spread, facing left.

The independent Dragon magazine

96p US\$3.25

March 1986

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Production Editor
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Software Editor
GRAHAM TAYLOR

Editorial Secretary
LUCINDA LEE

Advertisement Manager
SIMON LANGSTON

Administration
SERALDINE SMYTH

Managing Editor
PETER MCLOCK

Publishing Director
JENNY IRVINE

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How to submit articles

The quality of the material we can publish in
Dragon User each month will, to a very great
extent depend on the quality of the
documents that you can make with your
Dragon. The Dragon computer was designed
on to the market with a powerful version of
Basic, but with very poor documentation.

Articles which are submitted to Dragon
User for publication should not be more than
3000 words long. All submissions should be
typed. Please leave wide margins and a
double space between each line. Programs
should, whenever possible, be computer
printed on plain white paper and be accom-
panied by a tape of the program.

We cannot guarantee to return every
submitted article or program, or please keep a
copy. If you wish to have your program
returned you must include a stamped,
addressed envelope.

Contents



Letters	4	Reviews	19
Malbourne House Book errata — New bulletin board — Pope Gregory XIII stock forum — More Pokes for your favourite Dragon games — National Dragon Users Group ... buy of the Year?		Some old, some new, some borrowed ... Jason Orbaum dips his hand in the goodie bag and passes judgement on what comes out.	
News	6	Mixing it	20
1988 gets off to a slow start — Inevitable announced new releases and silence the critics — Delay on Watership's Janipod- tion II ... inside for details — Dispatch delay at Colosse-Pennar.		Pan d'Arcy time again. This month a detailed look at passing values from Basic to machine code. Check it out.	
Top Ten Chart	6	Firmware	23
Yes ... a chart for Dragon software, compiled by you, the user. Votes have started flooding in — this is your chance to vote in People's Chart Two.		Brian Cadge continues his stroll around the Dragon firm, this month dealing with Assorted Vectors. Just what the doctor ordered.	
Communication	7	Cupid	24
Problems, problems ... we want to hear about it. Send all your Dragon related queries to this column and get results fast. Or maybe this is your chance to help out a fellow Dragon owner?		Ah ... it's Springtime and romance is in the air. Steve Gathercole starts to the occasion in the shape of this arcade gem — in 1976 code.	
Fleet	8	Dragon Answers	28
The ultimate maze game for your Dragon — this one is fast brought to your computer by the programming team of Colin Hogg and Dave Rogers.		Brian Cadge consults the oracle of Cupid and comes back with some useful answers to a whole bunch of readers' enquiries.	
Machine Code Tutor	14	Adventure Trail	29
So he's not just a pretty face ... Jason Orbaum of all, start a series on machine code for humans! Don't miss it.		Mike Gerard is in a particularly helpful mood this month. Page 29 for details.	
Logical Dragon	16	Puzzgrid	31
Peter Winkler shows you how to make your Dragon team with the expert systems program.		Construct your own wordsearch puzzles using this program sent in to us by G.L. Naylor.	
		Competition	34
		Gerion Lee sets out to bewilder and baffle us again, but for the valiant, a copy of Quickbeam's 6809 Express could be waiting.	

Editorial

UNQUESTIONABLY, one of the major personal achievements of the last 18 months
was the **RedLine Aid Appeal**, started by an individual as unlikely as pop-star
Bob Geldof. Moved by scenes of mass starvation in drought-stricken East Africa, his
idea of "getting people off their backsides" (astonishingly passed over in the New
Year's Honours List) swept the country and culminated in the global event known as
Live Aid, last summer. And there were plenty of spin-offs too; **Fashion-Aid**,
Opera-Aid, **Camera-Aid** ... and more relevant to the home computer industry,
Soft-Aid.

Masterminded by ex-Quickserve supreme (now Electric Dreams MD) **Ian
Douglas**, this compilation tape raised over £250,000 for the Ethiopian appeal — a
fine effort by everyone concerned. There was just one problem for Dragon owners
however — the tape was only for Spectrum and Commodore machines — which left
us just a little bit out in the cold.

Following the success of **Soft Aid**, another charity tape is being prepared as I
write. Entitled "**Off the Hook**", the proceeds from its sale will go to the **Princes Trust**
for **Drug Abuse Rehabilitation** — an organisation concerned with helping drug
addicts beat their addiction. A worthy cause indeed. And the good news for the
computing community is that even more people can join in the effort, as **Amibird**
and **BBC** have been added to the list of machines catered for. But — stilling Dragon.

OK, so maybe we understand the commercial reasons for not including us, but
that still leaves a minimum of 50,000 odd active Dragon owners all dressed up with
nowhere to go.

Of course, someone could always "get off their backsides," but that only happens
in fairy stories — doesn't it?

Letters

This is the chance to air your views — send your tips, compliments and complaints to **Letters**
Page, *Dragon User*, 12-13 Little Newport Street, London WC2N 7PP.

Good Showing

RE THE November 6808 Show, I felt that the show this time was not quite as good as previous ones, but it is needed to keep the Dragon alive. I always enjoy looking for special offers and the chance to look at and try the new hardware.

Having started with the Dragon as a games machine, I am now looking for much more useful educational software for my 11-year-old daughter, and am using the machine with Disc Drive and using Word Processor packages and programming aids.

We need Dragon User. We need a 6808 show. We definitely need all new information and advertisers.

Bryan Smith

Book Errata

THANK YOU for arranging the special offers with the Mailboat House. I have studied the book *Dragon Machine Language for the Absolute Beginner* for several weeks. It is most interesting and can be recommended to persons like myself who are beginners.

There are, however, a number of errors which are most confusing. They are:

1. There are 27 simple specimen programmes in Chapter 14. None will work because of an elementary error in the loading program on page 128. To rectify, one must move the contents of "line 00" to a new line position, eg as "line 25".

2. There is a major loading program on page 155. It has an error in the subroutine which begins with line 600. The subroutine is intended for tests of machine code segments, but it does not have an "exit", or a "loop" statement. The program may have another error in the subroutine starting with line 408. I could not make it work, but this may have been because I did not know what it was supposed to do. Finally, I do not understand the purpose

of "line 5" of this program.

3. There is a big mistake in the specimen program "MUSIC". On page 187, starting at address 40A000, the hexadecimal entries should be 5E, 28, 87, 28, 02, 28, 0F, 3D, 02, 30, 00, 30, 8E, 36, 7D, 39, 84, 30, and 0B.

In spite of the above defects, it is a most interesting book.

J B Slinger
Typos: Simon
High Wycombe
 Bucks

Bulletin News

HAYMAJ recently started running a small bulletin board on my Dragon 64. I was wondering if you would be so kind as to inform other Dragon users about the service, through the pages of Dragon User. The details are as follows:

The board runs at 800x600 baud, 7 data bits, even parity, 1 start bit, 1 stop bit, and is on line 6 nights per week (Saturday to Thursday) 9:00 pm until 7:00 am, on file above number. The board auto answers and 20 minutes per call is allowed. Although running on a Dragon 64 there are users of other machines use the system, ie, Apple, BBC, Amstrad, etc. The board is called "waley" and was written with the intention of introducing some humour to the BBS scene.

M G Amentage
103 South Terrace
Mable Bar
Sheffield S21 6DE
Tel: (0595) 773554

Pokes

NOTICING that the only hint tip for games for ages was the one for Jet Set Willy (great), I decided to send in some Pokes I've found myself. Most of the games are getting on a bit, but hopefully that means most people will have them! Here they are then:

THE BELLS (keyboard version only) — Poke 10725-0-255 (Jesse)
COURTIER IN SPACE — Poke 1673, 0-255 (Jesse)
BLOCKHEAD — Poke 10840, 0-255 (Jesse)
TEATIME — Poke 15840, 0-255 (Jesse)

MONSTERS — Poke 20828, 0-255 (Jesse)
DUNKY MONKEY — Poke 15420, 1-127 (Jesse)
CHOPPER STRIKE — Poke 13108, 0-255 (Jesse)
POGO-JO — Pokes zero for "skill level" — your points, which usually go up in 10's will go up in 1000's!
BODIE STRADY GO! — type "FIDDLE" when the game starts (after pressing the up cursor key). Now using the left and right cursor keys, you can go forward and backward through the screens.

I hope these Pokes are of use!

Robert Gooding
52 Newton Drive
Inver
Ayrshire

Leap Year

I HAD always understood it to be common knowledge that Pope Gregory XII amended the leap year rule in 1582 and not, as written on Page 42 of the January 1985 edition of Dragon User, 1577.

This would be of little concern to me were it not for the fact that it caused me to lose a bet with my Father!

Peter Caldwell
35 Squitney Lane
Celbridge
COO DLD

Any other hints for the exact date of this momentous event? Meanwhile, Peter, may this exercise be a lesson to you on the perils of installing in gambling. (Send an SAE for definitive list of sites less damaging on your pocket).

Value

PAUL GRACE is right about the National Dragon Users Group. The newsletter, "Dragon Updater", is filled with useful information. Correspondence with several Group members gave me the information necessary to get my C64 software operational (no thanks to the manual) as well as introducing me to other Dragon users in Israel. They are the Dragon "Buy of the Year".

Harry C. Taylor Jr
Israel

Power Pack

AS SOMEONE occasionally asked to repair Dragon 32 computer bits and pieces, I have noticed two or three letters in your mag about the main transformer burning out.

I have now had three burnt-out transformers sent in for repair in the last two months (they are inseparable of course), but the cause of the problem in every case is that the input plug to the rear of the computer has had a loose cable grip screw. The wires inside have twisted around each other and short circuited, burning out the power transformer secondary.

I would advise every Dragon owner to immediately check that the cord grip screw in the grey covered power plug from the transformer to the Dragon is securely tightened. Even better, open up the plug and check all the soldered connections are OK with no exposed wires inside.

An even better solution would be to break the transformer to computer lead and insert fuses and fuseholders in the line, thus protecting the transformer.

Really, this transformer would be better out of its box, and fixed in a large, ventilated box along with its new fused protection — if you are technically minded.

I am still working on a suitable replacement transformer for the Dragon, but I would advise people whose transformer has burnt-out to check their machine on someone else's transformer as internal damage could have been done to their Dragon, as well as the transformer.

M Eberley
3-5 Watford Cottage
Morden
Huddersfield

Thanks for those tips . . . we would emphasize that you should only attempt any repairs or modifications to your transformer if you have the necessary technical competence or you could be letting yourself in for a whole bigger bunch of trouble.

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News desk

If you have any new products for the Dragon — software or hardware — ring the News Desk on 01-437 4343

Incentive — new release

INCENTIVE wish to stop the spread of any scurrious rumours (started heaven knows where!) that they are halting development of new Dragon games, by announcing the development of their next game, Time Lord, for the Dragon 3D.

Described by Incentive's Ian Andrew as, "a multi-screened 3-D arcade adventure," the plot involves destroying the evil arch villain Naco. During the game, you must explore Naco's castle, seeking out and battling with various guardians, to locate parts of a magic talisman which will gain your access to the inner Temple where Naco lies sleeping... and then on to the final confrontation.

This is the first Dragon game written by the long-time Incentive staff-writer Peter James and Roger Trank, but with the promise of 'Martia Madness

type 3-D,' the owners look good. Time Lord should be available around mid-May from Incentive, priced at £7.95. Contact them on 0734 511678.



Re Dragon User News: Desk last month, the Incentive Moon Cresta competition to win an original Moon Cresta arcade machine will close at the end of 1988 — so don't say that you've not got time to practice.

Juxtaposition delay

THOSE adventurers waiting for Juxtaposition: Part Two (Usurper of Ruins) are going to have to wait that little bit longer than expected — as Winterset are having trouble fitting it all in memory.

"The game is going to be released later than anticipated," said Winterset's John Humphries, but is hoping for an Easter launch, "if all goes well." This compares to the original launch date of mid-February.

The actual game design has been extended to produce a bigger game — possibly in two

parts. The first part concerns the task of gathering together a band of companions to face the might of Baroness Black. The second part (a combination of strategy and conventional adventuring) deals with the confrontation itself, as you battle it out with the Evil Horde. The program will feature some drawn graphics, as well as the "Panoramic Graphics" that were such a hallmark of the original.

For further details, contact Winterset, 30 Uplands Park Road, Enfield, Middlesex, EN2 7PT. 01-267 5720.

Total Eclipse — the public wait

BIRMINGHAM based Software House Fenmar Ltd have recently been the subject of investigation by West Midlands Consumer Services, following complaints from dissatisfied customers (passed on to them by Dragon User). Company spokesman David Bennett blames faulty tape di-

gnosis and other technical problems on the delay in dispatch of their first release Total Eclipse, but is confident that orders will be fulfilled by the end of January. He added, "if anyone requires a refund, rather than waiting for the game, we can send a cheque within 48 hours."

West Midlands Consumer Services can be contacted on 021-734 2626 — contact Mrs S. Lewis.

Dragon User People's Chart

"Power to the People" is our motto here at Dragon User — so this month (and every month!) we are now going to offer you the chance to air your personal preferences to the software producers, by voting in the Dragon User People's Chart.

Ever since the majority of retail outlets received stocking Dragon programs (so that sales are now even more difficult to assess), the Dragon scene has lacked that one thing any self-respecting micro must have — a chart. Love it or hate it, a chart is a useful thing, if only to check to see if everyone else shares your good taste.

So, ever with the reader in mind, we are now introducing a People's Chart — for you to vote for your top five Dragon programs (games, utilities or applications) each month.

And just to make it that little bit more interesting, this month Microdeal are offering £25 worth of software (of your own choice) to the winner of our associated anagram competition. Who said anything about a competition?

Well, to make things even more interesting than that, we're asking you to construct an anagram from your top three — the cleverest winning the goodies. Give it a try... you know it makes sense!

This is what you do

Each month, Dragon User will be compiling its own special Dragon software Top Ten chart — compiled by you!

And each month we will be sending £25 worth of Microdeal software to the person who sends it, with their personal top five, the most original phrase or sentence made up from the letters (you don't have to use them all) in the titles of their top three programs.

You can still vote in the chart without making up an anagram — but you won't be in with a chance of winning the prize.

All you have to do is fill in the form below (or copy it out if you don't want to damage your Dragon User) and send it off to: People's Chart No. 1, Dragon User, 12-13 Little Newport St, London WC2H 7PP.

Chart Two

Voting for Chart No. 1 closes all time on Friday 14th March 1989. Entries received after that time will not be eligible for inclusion in that month's voting. The editor's decision is final. Only one entry per individual per month will be allowed.

My top 5: Voting Month 1

	Name
1.
2.
3.
4.
5.

My phrase is:

Communication

Send in your questions, requests, and plans to Communication, Dragon Users, 12-18 Little Newton Street, London WC2E 8RZ

Problem: Wanted! Has anyone out there got a copy of Dragon FORTH by Oasis Software. Any price paid, but must have instructions. Must be in fast, good condition.

Empire State Plaza, 3rd Floor,
New York, NY 10048

Problems: Fixed charge on append routine for Basic and on machine routines

Enquirer: David Pigg, 44
Fries Avenue,
Sheffield, S10 2BN

Problem: I am at present working on my 'O' level computer project which is a database built to work a Dragon plus tape and, I am finding difficulties when it comes to file handling (ie, record searching and file extension). Can anyone recommend a good book?

Engineer: Michael Wallace, 77
Lyndon Avenue, Collier Place,
Dunstable, Bedfordshire MK22 6PH

Problem: I have a Dragon 32 with DragonDisk disk system. Recently I was using a graphic program, when the disc started to make a noise. Afterwards, I listed the directory, and found that although it was showing the correct amount of free space,

did not test the last few projects, is there any way of recovering those lost projects?

Engelstein P. J. M.D., 41 Cleveland Avenue, Easton 04414-0001

Problem: Could anyone explain how to determine the addresses for CSAVE, CLOAD, ECHO and CLEAR? Also the same for assembler programs (ORG & PUT) written with Addresser.

What do I have to do with `PUT` and `END` and labels like `ROUTINE` and how to `CREATE` from `Adream`? I am a complete beginner in machine code.

Bequires: Luc Desrosiers
 Wardenshaft: 37, 2048
 Desrosiers: Belgium

Problem: I am hoping to use my computer to control my very complex model railway. The only problem being I wish to use infra-red remote control, where the computer produces the frequencies and the necessary data for the electronics.

I do not know much about the output from my Dragon, or whether it will have any effect on the output from my other Dragon.

But I am not quite sure how to address the necessary parts of memory for controlling the true parts. I would be very

grateful if anyone could help me.

Kingdom: S. J. Taylor, Farnley, Leam, Barnetby, South Humberside, United Kingdom

Problem: I am now using a Compaq CQ35 with my Dragon 84 and am anxious to convert a number of my programs to Disc Operation. Unfortunately the Compaq manual, and Compaq themselves, are not too helpful!

Can anyone please give me some feedback?

Enquirer: Peter Burgess, Byways, Oak Lane, Broadbridge Heath, Hounham, Sussex GU10 3LQ

Communication

Stuck for a routine? Need some obscure equipment? Feeling out of it? Fear not — someone, somewhere can help you! Write down your problem on the coupon below (make it as brief and legible as possible) together with your name and address and send it to: Communication, Dragon User, 1213 Little Newport Street, London WC2H 7PP. We'll publish it as soon as we can — meanwhile, maybe there's someone you can help this month!

Abstract

[illegible]

1999

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Journal of Management Education
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Figure 1: Schematic representation of the experimental design. The figure shows three panels. The top panel shows a participant sitting at a table with a computer monitor, looking at a screen displaying a grid of numbers. The middle panel shows a close-up of the computer screen displaying a 3x3 grid of numbers. The bottom panel shows a close-up of the participant's hand pressing a button on a keyboard.

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Flee! Flea!

A superlative name came by the name of Dave Rogers and Colin Hogg

FEAR, this is a masterpiece of a horror game, but we have given it its own definition and flavour, from the untypical use of the Dragon's resolution modes (including the usual Dragon blandness) to the distinctive and devious designs of the mazes. To play, it is fast, challenging, and we believe as good as (or better than) any game of this genre available for the Dragon.

All the features expected of a good maze game are included: multiple tunnels, power rings, mazes open in four directions, bonus fruits, a highly intelligent player-seeking algorithm, up to six 'Progressively Aggressive' opponents (and bonuses for catching them), six different scenarios and colours, extra lives for clearing them, and so on - yet the program is relatively short. Other main features include a control key response tailored to allow 'anticipation' when turning corners (giving much smoother play), 14 different sound effects/tunes, and a fully functional demonstration mode, which also copies through the six scenarios, so even if you can't clear them all yourself at least you can sit back and see what you're meant!

The only compromise we have made in the program is a slight delay between certain screens (15 sec.) while video images are altered, etc. to do this any leader would have required considerably more work.

It uses a "retrocard screen" system, and this is well worth discussing, because the concept could easily apply to almost any game. The game is actually played on the Dragon's low-resolution (text) screen, which is block character mapped and locked in a simple, straight-forward way, starting at address 1204. Only those parts that change on the reference screen are translated, by means of a machine-code span, onto a high "play screen"; the latter being the only screen actually seen by the player.

By using this method, all of the game logic can be programmed using normal character codes and poses on to a simple screen, which can also be easily ported to be perform collision checks, route-seeking, scores, lateral moves, etc.

Meanwhile, the virtual screen can be made as detailed as you like and its characters and objects can be switched around without affecting the actual operation of the game in the slightest! Since the virtual screen is never actually seen (unless you press Break) it doesn't matter what it looks like, so you also gain the freedom to choose characters with codes that make the programming easier. For example, we assigned all the characters

What are valid or invalid (for the player or for the "team" to move on to) into easy-to-differentiate numerical answers.

To update the hi-res screen we use three different machine code subroutines. While we are describing these the main machine code functions will also be covered.

(10) **Hex Map (Map = 31531).** This updates the entire screen, but is too slow to be used all the time because it has to scan the 32 × 18 characters on the notepad screen, then refer to bit-pattern-tables to find the corresponding hi-res characters and poke a total of 32 × 180 bytes of these onto the hi-res screen (you can see the speed of this scan when it does a colour change "wipe-down" between screens, two and three).

(2) **Used CPU%**. Updates the screen display only (top left). Used for example when battery is being consumed too.

(3) **USP41-00** (address is 31067). This calls the main machine code routine that takes care of ALL Ring movements. It moves the Ring about the movement screen as dictated by the player's seeking algorithm, etc. (If player's position being passed via 28 in Line 100) but then it also updates specific areas of the 81-rs screen, these being: Each of the four positions each from previous position (replacement characters); the player's position above, below, left and right of the player (so whichever way he was moving the update will rub-off his previous position); and finally, the score display. This main routine also does the following: scans the screen for dots to see when it had been cleared; detects when the player has been caught by a flea if a power ring has been eaten then it starts to decrement the value in the power ring counter (address 31023) and detects when this reaches zero, it accordingly returns to Basic with a number between one and four, which is then used by the On-Gain in Line 10 to reach the appropriate Basic routine (17 for screen cleared, 2 for power ring expired, 3 for item1, 4 for power left).

Patient Name: P-23 **Referring Physician:**

Name: 37342 **Initials:** "Tad" **Service with:** 1962-1964 **Address:** 1011

Poster-Hero: FPG3/FPG5/FPG7 Selects video
 (middle row)

1000

The machine code data lists and the strings holding the compressed macro data are all checksummed, so you, first few lines will almost certainly result in error messages directing you to look at certain lines and correct typing mistakes. Unlike Sinclair machines, the Dragon checks lines in Run time, not when entered, so you should select Demo mode and leave it to type through all its macros and finish on the

give the program the opportunity to spot any mistakes. Having corrected all errors doesn't demand to achieve a low cost!

ME: Line 800: All inverse characters: A, A,
sin (A, A) A, A, beauty: A's

Line 870: "Press P to play, D for Demo"
The well-known "speed-up" Poke in Line 888 will work on most Disques but not all; if it doesn't, then just erase the time and place we used it only to accelerate video decoding. The music game will still run at the same speed.

Do not save the game in Fast Mode, it won't load back!!! If in doubt, poke HEX FFD5,0 in return for Slow Mode.

Future

At any time during active game mode or at the end of a game you can pause (P) to play, and during play you can pause by pressing Shift+Z. Screen one is particularly easy, while screens four (Standby Castle) and five (Face the Face) are particularly difficult, but not impossible! In fact there are quite easy ways to clear all the screens, we have both done it, but unlike inferior Pacman type games, it needs practice and the formulation of definite strategies!

Modifications

(1) If you need to slow the game down, add: 24 FOR DE = 1 TO 20: NEXT DE. The delay figure of twenty can then be adjusted up or down to find your most comfortable speed.

(2) To make an Autoplaying version just add: GOTO 1000.

170000 COMM-FRM "PL. FR", INT, 1700000
170000 COMM-FRM "PL. FR", INT, 1700000

THESE RESULTS ARE IN ACCORD WITH THE
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Country	Year	Population (millions)	Urban population (millions)	Urban population (%)
China	1990	1,193	310	26
China	2000	1,242	370	30
China	2010	1,371	500	36
China	2020	1,426	600	42
India	1990	853	150	18
India	2000	1,028	220	21
India	2010	1,193	310	26
India	2020	1,242	370	30
USA	1990	253	190	75
USA	2000	273	210	77
USA	2010	293	230	78
USA	2020	313	250	80

1000

To load this version you must use **CLIMACM** since the author works by saving the whole program as a machine code file, with the two Pokes to restore 'list of basic' pointers (we have deliberately over-estimated the latter in case you accidentally type in more spaces than intended, making the program slightly longer than as listed). It is best to still keep a tape of the normal version as a back-up.

(2) If you feel you must alter the keys used for consistent flow, use a consistent color scheme. Use

the string "2024/" in Line 10 to the same letters, otherwise, domain mode will not work at all.

[4] This program will work on the Dragon 64 if you change UCPR(50) in line 58 to 14560's.

Ready-typed versions of this program (including an expanded automating version of one side) are available for £2.00 from: J. Rogers, 11 Camarvon Road, Wotton, Liverpool, L30 1BB.

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SMASH HITS FROM BLABY

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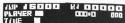
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RECIPE—Sweet corn



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After your appointment and having your personal information in Proton secure storage is what you will need to complete this game.

[illegible]

CHALLENGE: **RECOGNITION** **RECOGNITION** **RECOGNITION**

Authorship note: David J. Pittenger, James J. Kim, and Michael J. Ross, pittenger@uconn.edu, kimj@uconn.edu, mjross@uconn.edu, were equally responsible for the conceptualization, development, and delivery of the study.

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"Computers present the quiz in an efficient and compelling way" — *Dragon User*, May '89



152

LINEAR

For games for two players, the object being to form words on the board and thereby score points. The computer automatically calculates all scores including double and triple word scores, all bonus etc. The game features colorful graphics with facilities for correcting mistakes spelling or exchanging difficult letters from the rack.

"Univord seems to be an excellent program, with much enjoyment to be had from it . . ." — *Graphic User*, May '86



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JUMP**

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"... a well written and thought out program" —Dragon
Mag. December '88

Dear Computerware,
I have this morning received
my copy of *Storabuster Quiz*
and am very pleased with it. I
must praise your very prompt
service. . . well done.
Paul Gardner
Hinxton

Dear Computerists,
May I say how successful your
"Linkwood" program is. It has
given our family hours of fun
and interest — and I hope
increased our vocabulary!
(Peter Jeanes
Ayle)

All authors contributed equally and significantly to the manuscript.

COMPUTERWARE

DOI: 10.1002/for

STATE OF THE INDUSTRY

TRADE POLICIES WITH CHINA

Machine code for humans

Part One of a massive opus by Jason Orbaum et al

MANY people originally bought a computer "to learn to program", and, after looking at the BASIC manual, gave up and played a few games. Anyone who did that, however, undoubtedly owns a Spectrum, so this series will be aimed at those with a reasonable knowledge of some sort of programming language, but to initial knowledge of the ins and outs of the Dragon, or the 68000 microprocessor at its heart. Hopefully, once we have waded slowly through the complex pitfalls of assembler programming for a few months, even the most dedicated high-level language programmers will want to give it a try.

We will also be presenting a few complete programs, maybe one or two useful ones among the games! These will be given as complete assembler listings, so they can be used as tutorials, and to this end they will all be fully documented.

The beginning

Before we progress, who are we and why do we feel qualified to teach you? We have been programming in machine code as a team for several years now including, covering the entire range of computers from ZX81s through Dragon and BBC, onwards past IBM and Apricot PCs, to Pico microcomputers. This experience also covers a wide variety of languages, although we rarely use anything but assembler through choice (our experience covers C, Pascal, Logo, and C, so we are not just a pair of excited bit-badders!). The name Jason Orbaum may ring a bell in the dim recesses of your mind as one of the magazine's reviewing team. If so, then you will know our objectives in program construction, and will also know that we believe that a piece of code is nothing without a firm and workable initial design.

Starting very shortly and running parallel with this series will be a set of articles on the subject of writing adventures in machine code. These should be kept by beginners as they will be invaluable when this course is complete. That series will not attempt to teach machine code, it will, however, provide a fine example of code in use and firm grounding in design beyond the basic techniques of flowcharting we will introduce next month.

Most people think of this sort of programming as machine code, some call it assembler or assembly language, still others call it purgatory, but they are all the same thing (except purgatory that is which is something totally different and much more unpleasant). An assembler is a programming aid for converting a form of the code we can understand, the mnemonics, to a form the computer can under-

stand, the machine code. An assembler is not strictly necessary — for instance, Cosmic Crusader from Budge Software was written without one — but it will make things infinitely easier, and cut down development time a lot.

Choice of assembler is largely down to personal taste. Most of the programs for this series were written using (Crosstab) from Premier Microsystems, now sadly deceased, which uses the standard Dragon BASIC editor. Others are quite acceptable, but it is a good idea to get one that can assemble source files from tape (or disk), as having the source code in memory can take up a lot of space, limiting the size of the final program to a few Kbytes. The Dream editor from Dragon Data is a good example of this, the program in that case being limited to about 3K. All right for small programs, but unsuitable for big projects, although a few of the programs we will be presenting first saw the light of day in a Dream editor assembler. There is an updated version of Dream, called CosmicDream, which is rated by many as the best available, and runs under DragonDos.

Many people write off assembler, dismissing it as difficult to write in, and not worth the effort. It is true that every day these assembler BASIC compilers, or versions of Pascal that can perform benchmarks 10 per cent quicker, or with 10 per cent less code, but nothing will ever beat machine code for speed of execution and compactness of code. Any interpreted or compiled language (machine code is not compiled, no matter what the local BASIC expert tells you) must by nature be slightly generated, and therefore slower and noisier bulky. With machine code, the programmer has ultimate control over what is produced, and any inefficiency must be down to programmer error or a constraint imposed by the designers of the processor. This also makes assembler one of the most satisfying languages to write in. It is also possible to do anything the computer is capable of in assembler (including blowing the SAM chip — more of that later), whereas most high-level languages stick to a standard of one part or another. The day the International Standards Organisation get at 68000 assembler, we can all buy Commodores and settle down to play games for the duration of our retirement!

Rom calls

Another part of assembler programming is the amount there is to discover about the machine itself. There is a lot of memory used by the system for various purposes, which an assembler programmer can use to make the Dragon sing (literally? Who knows...?). This can also lead to some

particularly spectacular crashes. As most programmers find out very early on in their association with assembler, the real solution is not always the cure — all it is in BASIC.

Machine code is composed of a set of relatively simple instructions, covering simple arithmetic, memory access, and a few hardware functions for interrupts, etc. The 68000, that the Dragon uses is very powerful for an eight-bit processor, much more so than the barbaic 6800, and significantly more so than the reasonably refined Z80. This is due to the fact that, although technically an eight-bit chip, most of its internal structure is that of a 16-bit chip (as opposed to the 6801, the 68008, which Sinclair call a 32-bit processor, although it is in fact an eight-bit device with ideas above its station). The way processors are defined is basically down to the size of the address bus, which is the part of the chip that carries the address to be operated on. If this is eight bits (binary digits) wide, the maximum address that can be reached is 1111111111111111 binary, or 65535 decimal. This is because the address is sent in two parts, a high byte and a low byte.

Next month we will launch into flowcharting and also describe the internal architecture of the 68000.

Glossary

Address bus: The address bus is one of the processor's paths of communications to the outside world. It is used to transfer addresses to the rest of the hardware, and so the size of the address bus dictates the size of memory the processor can access.

Bit: Binary digit. As most computer lovers will insist on telling you, computers work in binary, or base two, just as humans work in base 10. (Do not, however, let this lead you to believe A: that machine code programmers are limited to using the digits zero and one, or B: that computers possess only two feelings. A bit is therefore either a one or a zero.)

Byte: A byte is a number, the maximum value of which is dictated by the computer used. In most papers, a byte is from 0 to 255 (or -127 to 126). This is a function of the memory chips used, rather than the processor, and therefore varies little from machine to machine. A byte consists of eight bits.

Data bus: Similar to the address bus, except that the data bus is used for data.

Nibble: A nibble is four bits, or (you guess) half a byte. From this last it might be expected to hold any value in the range 0-157. Wrong. A nibble can be in the range 0-15. Look at the definitions for bit and byte, then work it out.

Continued next month

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The Logical Dragon

The elements of an expert system by Peter Whittaker

THE DEBATE over just exactly what 'intelligence' is has gone on for a long time, and as yet there is no sign of an answer in sight. However, computer programmers have not waited for the answer to start exploring the fascinating area of intelligence on computers. Instead, they have decided upon a definition of intelligence which suits them, and then gone on to experiment with it. They say, "If a machine can behave in such a way as to be indistinguishable from a person, and if the person can be said to be intelligent, then so too can the machine." It is from this very practical position that we shall start.

One of the biggest problems computers have in imitating intelligent behaviour is their inability to understand English. They do not of their own accord remember what you tell them, and use the information thus gained to help them to draw new conclusions for themselves. A prime example of this is in the area of syllogisms. Syllogisms are deductive arguments which take the following form:

'A' is a 'B'

'B' is a 'C'

Therefore 'A' is a 'C'.

For example:

Peter is a man.

A man is an animal.

Therefore Peter is an animal. The first two lines are propositions, giving us the raw data to work with, and the third line is the conclusion based upon the first two statements. The conclusion is itself a new fact previously unknown.

I have written this program to handle just such deductive arguments. The program may best be explained by running it. When the prompt appears, type in the statement: "A student is a layabout" and press ENTER. This is accepted by the program in Line 40 as A8. Nothing happens to A8 until Line 120, where any initial 'scientific' gets removed. This should bring the subject of the sentence (student) to the front. Then Lines 160-190 remove the verb from the middle of the sentence. This leaves the subject and object standing alone, to be read into B8 and C8. (Line 210 B8="student" C8="layabout".)

This new information is then stored in an array. Lines 240-260 check to see whether the subject (B8) has been encountered before. If it has, then it will be recorded as a heading in the array (Line 280). If it has not been recorded in the array, then it is placed at the top of the first available blank column (Line 285). The program now checks down the column of entries under the subject, to see whether it has already been linked with the object (Lines 290-340). If the object cannot be found, it gets added to the bottom of the list (Line 320). Having stored the data

in its array, the program now returns to Line 40 to await the next input. Type in "Peter is a student", and the program will go through the same steps.

Having set up a database with the program, we can now start to examine the information we have stored in it. The first method is to list out the data under subject headings. Type "Subject" and when the computer asks which subject, type "Peter". Under this heading we will find the only "student", and if we had entered "Student" we would have found "layabout". The link between the two is obvious to us, but will the computer notice it?

Searching

This brings us onto the second, and more interesting way of questioning the database. Questions asked must be of the form "Is this ---- a/the ----". Type in "Is Peter a layabout?". Once again, this is accepted as A8 by Line 40, but this time the program at the start of the question gets deleted by Line 50-180 and the program jumps to the question handling routine at Line 360. Here the question is chopped up to extract the subject (B8) and the object (C8). The program then proceeds to search its database to increasing depths for a link between the two.

The first search is only one level in depth, and the program is not trying to discover new links between various pieces of data, but looking to see whether it already knows the answer. The program scans along the top line of the array trying to find the subject (Lines 480-520). If it cannot find it then the search is terminated, a 'No data' message is printed, and the program returns to Line 40 to await the next input. If the subject is found, then the program scans down the list of objects listed under the heading trying to find a match for the object in the question. If it finds a match then it prints "YES" and returns to Line 40, otherwise the program moves on to search a level deeper.

The second level search (Lines 560-760), which is the true equivalent of the syllogism argument, starts by finding the subject in the top line of the array, as for the first level search. Then it works its way down the list of objects listed under this heading. However, this time, instead of looking for a match with the sought for object, the program uses each object in the list as a new subject, and searches along the top line of the array to see if there is a column under this new heading. If there is, it then looks down this column searching for a match with the question object. If it finds a match it prints "YES", and copies the new information to the bottom of the subject column, and then returns to Line 40 to await the next input. In

this way the program can expand its knowledge database for itself. If it doesn't find a match, it looks up the list stored under the next item in the original subject heading list. This continues until the program has examined all of the items in the subject heading list. If this happens the program moves on to search yet another level deeper.

The third level search (Lines 780-1000) goes one stage further than the usual syllogism argument. (A is B. B is C. C is D. Therefore A is D.) Again it does not immediately look for a match, but uses each item in the subject list as a new heading to search. It then uses the items in the new list again as new headings, and only when it examines items in this third list does the program look for a match with the question object. As with the second level search, when the program finds a match, it updates the information in the original subject list.

The "learning" process of this program can be examined using the "SUBJECT" command. If we type "SUBJECT", and then answer the prompt with "ALL", the program will list out all of the information stored under each of the subject headings. Under Peter we will find "student", and under student we will find "layabout". Next we ask the computer to find the relationship between the two. Type "Is Peter a Layabout?". The program will do a level one search and not find a link. Then it will do a level two search, and find the link (student) between the two terms, and print the answer "YES". If we now examine the database by subject again, under Peter we still find "student", but we also find the new information "layabout".

Deduction

The program has added the result of its deductions to its knowledge base. To help us check up on the program's logic, it also prints out the route it followed to reach its conclusion. (Peter — Student — Layabout.) Further, the program does not require an exact match to deduce a link, it can find a partial link it will accept it. (eg. Searching for Man and finding Human will still produce a "YES" response.)

The LOAD and SAVE options (Lines 1300-1380 and 1390-1500) called by "LOAD" and "SAVE" are set up for disc, but can easily be converted to work with tape. They assume that the data file will be called "SYLLOGISM" but this can be easily altered if you are going to convert the program for tape, also delete the error trap at the end of the program. Try experimenting, and see what links your Dragon can deduce between different pieces of information.

```

8 ERROR GOTO 1410
10 CLS:PRINTSTRING$(64,128):PRINT$
  A,"SYNOPSIS: EXPERT":PRINT$
  "BY: PETER WHITTAKER":PRINT:PRINT$
  "PRINT:LOAD.....LOAD DATA FROM
  H DISC":PRINT$
  "SAVE DATA TO DISC":PRINT:PRINT$
  "SUBJECT.....PRINT
  WORKING DATABASE":PRINT
20 CLS:PRINT$
30 READ$=0
40 INPUT $
50 IF $="" THEN 40
60 IF LEFT$($,7)=""SUBJECT" THEN 10
  50
70 IF $=""SAVE" THEN 1200
80 IF $=""LOAD" THEN 1300
90 IF LEFT$($,2)=""1" THEN 300:IF
  REQUEST$=""
100 IF LEFT$($,4)=""400" THEN 300:IF
  REQUEST$=""
110 IF $=""400 OFF" THEN 300
120 IF LEFT$($,2)=""1" THEN $=RIGHT$(
  $,LEN($)-2):GOTO400
130 IF LEFT$($,2)=""1" THEN $=RIGHT$(
  $,LEN($)-2):GOTO400
140 IF LEFT$($,4)=""400" THEN $=RIGHT$(
  $,LEN($)-2)
150 IF $=""FIND SUBJECT/OBJECT"
  300
160 $=INSTR(1,$$," "):IF $=""
  $=INSTR(1,$$," "):IF $=""
  THEN $=""7":GOTO210
170 $=INSTR(1,$$," "):IF $=""
  THEN $=""7":GOTO210
180 $=INSTR(1,$$," "):IF $=""
  THEN $=""7":GOTO210
190 $=INSTR(1,$$," "):IF $=""
  THEN $=""7":GOTO210
200 PRINT"GOODBYE":GOTO400
210 $=LEFT$($,4):$=RIGHT$($,LEN($)-4)
220 IF $=""SAVE DATA IN MEMORY"
  300
230 $=""
240 $=""
250 IF $=""SAVE" THEN $=""
  $=""GOTO400
260 IF $=""LOAD" THEN $=""
  300
270 IF $="" THEN $=""
  $=""GOTO400
280 GOTO 340
290 $=""
300 $=""
310 IF $=""$="" THEN $=""
  $=""GOTO400:PRINT$
320 IF $=""$="" THEN $=""
  $=""GOTO400:PRINT$
330 IF $=""$="" THEN $=""
  $=""GOTO400:PRINT$
340 GOTO300
350 IF $="" CONCLUSIONS"
  300
360 $=RIGHT$($,LEN($)-2):GOTO300

```

```

370 $=RIGHT$($,LEN($)-2):GOTO300
380 $=""
390 $=""
400 IF LEFT$($,2)=""1" THEN $=""
  $=""GOTO400
410 IF LEFT$($,2)=""1" THEN $=""
  $=""GOTO400
420 IF LEFT$($,2)=""1" THEN $=""
  $=""GOTO400
430 IF LEFT$($,2)=""1" THEN $=""
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450 IF $="" THEN $=""
  $=""GOTO400
460 IF $="" THEN $=""
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800 IF $="" THEN $=""
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810 IF $="" THEN $=""
  $=""GOTO400

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1000 OPEN:PRINT:GOTO 100
1010 GOTO 1000
1020 IF (PRINT) THEN GOTO 1000
1030 IF (PRINT) THEN GOTO 1000
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Disk utilities

Program: Disk Utilities, Ian Elkington, 11 Whitendale Gardens, Biddison, Shipley, West Yorks BD17 6PR
Price: £10

DISK UTILITIES is a collection of 12 programs, some of which will be useful to any DragonDOS owner. All of the utilities are entered from a main menu which is called up by typing RUN "M". The menu is displayed in a very readable 40 column display and selection is made by moving the cursor line to the required utility and pressing Enter. Most utilities then require you to press enter again, although for no apparent reason.

The first utility is to send a copy of the directory to the printer. I have commented before that this can be done from basic with POKE (11,254):DR, so the disk space could have been used for a more useful utility here.

A more useful option is "Disk View". This allows any sector of the disk to be viewed, using the cursor keys to step forward or backwards a track or sector at a time. The sector is displayed as ASCII characters at the top of the screen. My only complaint here is that there is no option to dump the sector as HEX codes.

Four separate utilities provided allow programs to be copied from disk to disk, tape to tape, tape to disk and disk to tape. This all sounded very promising until I found that the only files which could be copied are those which load above address 7000. The program will not copy basic or data files. Again, these are potentially very useful utilities, spoilt by ineffectuality.

Perhaps the most useful program on the disk is the one which recovers accidentally KILLED files, providing nothing has since been written to the disk. This utility allows any file type to be recovered and gives you the option of Protecting the recovered file.

Another well implemented utility is the Sector Editor. Any sector may be loaded in and edited using the cursor keys. Bytes can be changed either by entering the ASCII character or the ASCII code. The ASCII code of the byte under the cursor is also printed

which is essential for identifying non-printing characters. The most common use for the sector editor would probably be to change filenames on the directory track directly (especially useful for mail filenames), or, used in conjunction with the "Disk View" option, to locate the required sector of a program and to change it directly, although this can be potentially fatal.

An option which looked very useful was Disk Menu Creator; this purports to create a menu program on any disk enabling you to load any of the last twelve programs on the disk by a single key press. Unfortunately, all my attempts to use this utility constantly resulted in the program crashing with "PT error" — so much for the "user friendly prompt".

The final couple of utilities included allow a complete disk to be saved and loaded from tape. One disk takes about 20 minutes to transfer to or from tape, and as cassettes are cheaper than disks this is an economical way of backing up disks for safety — providing you can stand the wait!

Apart from the few annoying features of this disk, such as not being able to return to the main menu from any of the utilities and the fact that error messages are not explained — DISK ERROR is all you get — this is a genuinely useful set of utilities for disk drive owners. It is a shame that there is no option to use two or more drives, which would save a lot of disk swapping.

Unlike Domino's Disk Doctor program reviewed in the September issue of Dragon Clear, there is no utility to automatically recover damaged programs — you'll have to do this manually using the Sector editing option. However, at £10 this offering is considerably less expensive than Domino.

Brian Cudge



It's war!

Program: Mail War, GP Guardians, 18 Fishersbridge Road, Preston, Weymouth, Dorset DT3 6DT

BACK IN the mists of time (when the OS was just a twinkle somewhere in Sir Oliver's anatomy) there was a computer called the Z8-in for which routines used to go somewhat like this:

"I cannot review this game as I cannot get it to load due to the bad loading system on the computer. However, it is described by the manufacturer as..."

Hey! Guess what? A touch of nostalgia I can't get Mail War to load either. At least not more than once. But that, I'm sad to say, was enough (I'm not actually that sad to say it). It took me three cassette recorders to get Mail War to load and now it has given up altogether!

The game has aspirations to be a play by mail game, it runs in DR without the need for loading and saving of data except at the end of a game!

This is the equivalent of me saying, "I want to be Rambo!" I have a nine-inch chest and can carry three potatoes at a time!

Play by mail games are big. They have to be, otherwise no one would still be interested in them after having waited two weeks since their last move. This game is not big.

To play this game by mail would also require supreme cassette I/O. The data file workings of the Dragon, especially through I/O, are notoriously bad and to have to save the game after every move would be a nightmare!

When the game did eventually load I was, as I've said, an immense disappointment as it was written, it seems, in BASIC and runs very slowly.

The instructions appear to have been written by someone who has never actually played the game, as in play they were about as useful as the Pac-Man copyright (hello Alan!)

For example, "If a friendly unit occupies the same location as the cursor you will enter 'Control' mode for that unit. The cursor will change from red/green/blue/yellow to red/green/red."

The "cursor" described is a pair of pixels, not three pixels apart as the PIMC081 screen and the colour change appears to be totally indeterminate! The manual goes on to say how the mathematics of conflict is done by the computer and then tells you what the computer is doing, in case you

want to do it on paper.

The game cannot be played solo as both my sister and myself were forced to play this appalling drivel for far too many hours as a test.

Jason Gribson



It's just a must

Book: DRAGONDOS: Programmer's Guide, Groovernor Software, 22 Grosvenor Road, Seaford, East Sussex BN25 2BS

Price: £2.90 inc p&p

IT HAS always been difficult to get detailed information regarding the DragonDOS hardware and software — until now that is. Groovernor Software, better known for their excellent assembler-editor, has released a 12 page booklet entitled DragonDOS — A Programmer's Guide. The text is not for the beginner, but will be invaluable to the seasoned machine code programmer.

A memory map of the DOS locations used in page six is given (this does not give locations used for commands such as AUTO) as well as all the page zero locations used to store track and sector numbers etc. Very detailed information is given regarding the layout of Directory entries — useful for writing programs to MAF, UNRA, a file.

All the entry addresses of useful routines are given, such as READ and WRITE to a file, KILL, PROTECT and RE-NAME a file. Each routine is clearly documented with entry and exit conditions and there are a couple of useful example programs listed at the end of the booklet.

Finally, there is a short section on known errors in the DragonDOS ROM, however this is not as extensive as the article in Dragon Clear, May 1985.

At just £2.90 (inc p&p) this booklet is a must for any DragonDOS owner with an assembler.

It is also the perfect size to fit in a Christmas stocking — and will ensure rapid access over Christmas!

Brian Cudge



Mixing it with Basic

Pam d'Arcy shows how to pass values between Basic and machine code routines

This is not exhaustive but seeks to demonstrate, using simple techniques, how to access data commonly between BASIC and machine code routines.

1. Use EXEC

Directed USR in favour of EXEC. This overcomes problems caused by known PCBM bugs and techniques used in passing parameters using EXEC would be needed anyway if it is required to pass across more than one officially allowed parameter when using USR.

2. Use EQUATES

Set up the addresses of machine code routines in variables at the beginning of the BASIC program and use the variable name rather than addresses themselves within the main body of the program.

eg. 20 BANG=25614: REM sound of explosion

300 EXEC BANG

330 EXEC BANG

This is the equivalent of using Equates in machine code with its great attendant advantages:

To it assists in maintenance such as if the address of the machine code routine is altered, only the easily found line near the beginning of the program needs to be amended, avoiding a hunt through the entire program for every reference to the amended value.

It assists in coding accuracy as use of a nominally meaningful NAME or LABEL for storage of digits such as machine code routine addresses is less likely to lead to transposition of characters or miscoding as with numbers alone.

3. Parameters

Whether using USR or EXEC, passing of parameters between BASIC and machine code has the same end result — data is placed by BASIC at a place in memory that the machine code can get hold of in a form that it can use and vice-versa.

4. Parameter storage area using EXEC

Structure machine code routines thus
ENTRY LRMA PROG

parameter
storage
area
PROG

POKE'd and
PEEK'd by
BASIC programs

RTS

The first instruction could be a short unconditional branch if the storage area is less than 128 bytes long but by standardising on the use of a Long Branch, which takes up before additional byte of memory, you are not limited and so do not have to change it when that odd additional byte of storage added in tips the balance. Perhaps, more importantly, an area of potential confusion is avoided in the BASIC programs if the parameter area always commences at the machine code routine address +3.

5. Dragon numbers

Often a difficult concept to grasp is that although Dragon machine code is very powerful, at its bare bones level, it arithmetically deals only in Whole or Integer numbers, as opposed to fractions. The range of numbers it can deal within a single instruction is 0 to 65535 if the numbers are only ever positive (known as unsigned numbers) and 0 to +32767 or -1 to -32768 if the numbers may be positive or negative (known as signed numbers). This may seem limited but most home microcs can only deal, at this level, with values in the ranges 0 to 255 or 0 to +127, -1 to -128. Larger numbers and fractions are possible by programming techniques, that is, by dealing with the values a byte or two at a time.

Dragon BASIC contains more truly to many experts' opinions of how a BASIC language should handle numeric values than many other of today's micro BASICs in that to it, a number is just that, a number. That covers an amazing range of possible values (-999,999,999 to +999,999,999 in whole numbers alone can be printed normally on the screen).

It manages this by holding its numbers, regardless of the value involved, in five bytes of memory in a format variously referred to as Real, Exponential or Floating Point. This enables values in the range 1E-14 to the power of plus or minus 55 to be available to BASIC programs before it runs out of puff and gets an 'Overflow' error.

BASIC ROM is after all only machine code. To carry out arithmetic on such numbers requires them to be converted using available machine code instructions to a form that can be handled by the available arithmetic instructions, carry out the arithmetic function and convert them back into their five-byte Real format.

6. Numeric parameters using USR

I have not experimented with them as cannot vouch for any other limitations such as coping with negative values, but it seems that the recommended BASIC ROM routines associated with the USR routine for converting BASIC numerals to a form usable by machine code (INTCONV/CONVMB) cope only with the range of whole numbers 0-65535. (No doubt Brian Cagge's Firmware Utilities will assist here!) Guidance in using these routines also starts using the word Integer in its usual computer context of meaning a Double-Byte, sometimes called Word, unit of storage (a pair of adjacent memory bytes), rather than the English context as used as far in these pages of Whole number. For clarity, I shall use the words Whole or Double-Byte as appropriate.

7. Numeric parameters using EXEC

Anyone wishing to process fractions or whole numbers outside the bare bones signed or unsigned range in machine code will not find the answer in these paragraphs.

Passing numeric data to machine code

To put the parameters (—data) into the machine code parameter area, POKE is used. POKE deals with a single byte of data at a time, automatically converting the value involved from its internally held five-byte Real format to a single byte providing that no attempt is made to POKE a value other than a whole, positive number not exceeding 255 (else an FC error occurs).

Unsigned single byte parameter

If an unsigned single byte value (0 to 255) is involved, it can be passed across directly such as shown in Fig 1.

Signed single byte parameters

The value range of each byte is 0 to -127,

-1 to -128. As far as machine code is concerned, it is not bothered about the CONTFMTS of a byte. It is the way that we test it in our coding that determines whether it is being used in a signed or unsigned manner, or even as an ASCII character. To the machine, a byte containing \$41 is a byte containing \$41. To us, it may be the decimal value 65 or the character 'A' being output to the screen or printer. Similarly, a byte containing \$FE is just that to the machine. To us, it represents the unsigned value \$FE or the signed value -2 depending on the context.

Thus, when we have a negative number in BASIC to pass across to machine code, adding 256 to it will create the FORTRAN 'positive' complement.

For example, -2 can be POKE'd directly in either of the following ways with identical results:

```
POKE P1,$HFE
POKE P1,$254
POKE P1,$256+(-2)
```

A variable containing a signed value can be reliably dealt with thus: IF N=0 THEN POKE P1,\$256+N ELSE POKE P1,N

Unsigned double byte parameters

Double byte unsigned values (range 0-\$FFFF) need to be POKE'd into the parameter area a byte at a time, manipulating the value to ensure that each POKE stays within the 0-255 range. The most significant byte (lower address) of a double byte storage location contains the number of 256s in the value and the least significant byte contains the remainder. This can be easily derived thus:

```
POKE P2,INT (N/256):POKE P2+1,N AND 255
```

Use of Integer pops off any remainder from the division. Doubling with machine code, the AND 255 can probably be recognised as the equivalent of the machine code logical AND (ANDA,AND) r8FF instruction, and neatly isolates the value in the

least significant byte of a double byte value. As with single byte negative values, double byte negative values need to be converted to their 'positive' equivalents, this time by adding \$FFFF to the value. A temporary variable is used (TEMP) for clarity.

```
IF N=0 THEN TEMP=$FFFF-N ELSE
TEMP=N
POKE P2,INT (TEMP/256):POKE P2+1,
(TEMP AND 255)
```

Receiving numeric data from machine code

On return from the machine code routine, the corresponding PEEK process needs to be used.

Single byte numbers N=PEEK (P1)

If the number is signed, add the line IF N<127 THEN N=N-256

Double byte numbers N=PEEK (P2)+256*PEEK (P2+1)

Similarly if the number is signed, add the line IF N>32767 THEN N=N-\$FFFF

8. String parameters using USR

This appears to be an area particularly affected by ROM bugs.

9. String parameters using EXEC

As with numbers, an understanding of how BASIC deals with strings is necessary if other than simple manipulation is required. Such information is not to be found in these paragraphs.

Locating the string data

Each different variable that the BASIC program encounters while the program is running has a five-byte control area set up for it. For Numeric variables, the control area contains the value itself in its Real format. For String variables, the five-byte area is known as a 'String Descriptor' and it contains four items of information. Two of the items are of special interest when accessing the string in machine code. They are the Length of the string and the Address that the string data actually starts at in memory. The Length is in the first byte (byte 0) of the String Descriptor and the Address is in the third and fourth bytes (bytes 2-3). These values are already in machine code format so need no further conversion to use them within machine code routines.

The first stage in passing string data to machine code is to obtain the memory Address of the String Descriptor for the required string variable. This is acquired using VARPTR, ADDR=VARPTR (NAME)

The variable that the address has been placed in, ADDR, is a standard BASIC numeric variable that is in its five-byte-Real format. Its content (ie, the address of the string descriptor) falls into the category of being a whole, unsigned number in the range 0-65535 so can be passed to the machine code routine in the manner previously described (see Fig 2).

The machine code routine can now locate the string data and its length:

```
LDX $5DEPTR,PC : get address of NAME's descriptor into Reg.X
```

Fig. 1, 2 and 3 (from top)

BASIC	Machine code routine starting at address 20000
40 DIM=255555	ENTRY LEA R000
50 P1=50000:POKE P1=1	MOVW R000 R00 1
1	MOVW R000 R00 2
1	
1	
100 POKE P1,'value'	POKE R000
10	
POKE P1,0	
where 'value' is	RTS
or N contains	
0 positive number	
ie. N in range 0-255	
100 EXEC 00	

BASIC	Machine code at 20000
40 DIM=255555	ENTRY LEA R000
50 P1=50000:POKE P1=0	MOVW R000 R00 0
1	MOVW R000 R00 2
1	
1	
100 INPUT 'NAME';NAME	POKE R000
100 ADDR=VARPTR (NAME)	
100 POKE P1,INT ADDR/256:	RTS
POKE P1+1,ADDR AND 255	
100 EXEC 00	

BASIC	Machine code at 20000
40 DIM=255555	ENTRY LEA R000
50 NAME=JANES,NAME	MOVW R000 R00 0
1	MOVW R000 R00 2
1	
100 ADDR=VARPTR (NAME)	POKE R000
100 ADDR=ADDR AND 255	
100 POKE P1,INT ADDR/256:	RTS
100 POKE P1+1,ADDR AND 255	
100 EXEC 00	
100 TEMP=PEEK P1	
100 ADDR=PEEK P1+1,TEMP	

(Continued from page 2)

```
LDX 0,X      : get length of NAME$
              : into Reg.A
LDY 2,X      : get address of start of
              : actual 'name' into
              : Reg.Y
LDB 0,Y      : get the first letter of the
              : 'name' into Reg.D
```

etc.

Assemblers equipped to deal with indirect addressing can achieve the same result with fewer instructions. Alternatively, Turn-er PEEK and POKEs in BASIC can extract the Length and Actual String Data Address from the String Descriptor and set it up directly as parameters for the machine code, eg where P1 and P2 are as in previous examples).

```
POKE P1,PEEK(ADDR+2):REM need significant byte of actual string address — it doesn't need 255 conversion as it is not a standard BASIC variable but a machine code format double-byte.
```

```
POKE P2+1,PEEK(ADDR+3):REM least significant byte of actual string address — doesn't need AND 255 mask etc. as above BASIC ISA.
```

There is no way of doing anything when programming!

Setting up new strings for BASIC from machine code

In BASIC, define a 'large' string variable set up to the length, if known, else maximum possible length, of the string to be set up in the machine code routine.

Depending on how you want to deal with

it on its return to BASIC, if it is a variable length string, fill it with space characters or recognisable end-of-string characters, eg MICROSIG—\$!REVC0055,"~"~).

Obtain the string address's descriptor address, pass it address to the machine code routine, set up the actual string data and return to the BASIC program. The string is then available for instant use in BASIC.

Adjusting variable length strings

If a shorter than maximum length string has been set up, it seems that no harm will be done in physically amending the Length byte in the String Descriptor to the new actual, shorter, length.

However, to err on the side of caution in the early stages is sensible, so get BASIC to adjust the string length itself in one of two ways — either pass back to the BASIC (as a separate routine) parameter the actual length of the string as set up in the machine code or indicate the end of the string of data with an arbitrary 'end of string' marker byte as a most convenient from the programming point of view. BASIC can then adjust the string length accordingly thus:

```
1) Using a Length parameter (see Fig 2).
2) Using String End Marker
```

As above except to initially fill the string with what will be the end of string marker, eg MCS=STR\$(N05295,"~")

On return to BASIC, the MCS length can be adjusted thus:

```
200 TEMP=(INSTR$(MCS,"~"))
210 IF TEMP=0 THEN MCS=LEFT$(MCS,TEMP)
```

(If TEMP was 0 no 'end of string' marker

was found as the string was filled to its currently set maximum thus needs no adjustment.)

10. Relative parameter addressing

Give Label names to the parameter fields in the machine code area and refer to the fields by Label within the code. This greatly reduces maintenance if fields are altered as re-assembly automatically adjusts the addresses, avoiding searches for references to fields where there may be a location error!

Similarly, define the addresses of the parameters in variables at the beginning of the BASIC program (relative) to the previous one as in the small examples above. Should, say, the size of a parameter near the beginning of the area be changed, a whole list of addresses do not have to be amended, for example:

```
40 LA=26000
50 P1=6A+3
   P2=P1+2
   P3=P2+1
   P4=P3+2
```

This shows that P2 starts at the address two bytes after P1; P3 starts one byte after P2 etc.

Should the length of P1 be reduced to one byte, using this 'relative' method of addressing, only the P2 statement needs to be altered (to P2=P1+1) and the other addresses will be automatically computed correctly saving much potential maintenance.

The fewer the opportunities of making errors, the better!

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REAL VALUE FOR MONEY SOFTWARE

Firmware

Brian Cudge explores the Dragon's ROM in a special series which builds up month by month into a firmware manual.

This month we look at the Miscellaneous Firmware locations and routines. These are those not already covered which do not fall into any particular category, but which may be of use.

Miscellaneous Firmware Data Locations

25-26	Start address of Basic program.
53-54	Address of top of machine stack.
26-40	Top of Firmware RAM.
41-42	Line number used in CONTINUE command.
43-44	Temporary general purpose line number store.
47-48	Direct mode command text pointer.
154-155	Current line number (55555 in direct mode).
159-161	Physical end of RAM.
159-159	General purpose 16 bit scratch pad.
157-158	EXITGate entry address (initially points to routine giving an IYC error on power up).
160-167	Address of current/significant byte of current command.
175	TRDCH/THOFF flag — non-zero=trace on.
176-177	Address of start of UPR address table.
207-208	RENUMMer increment value.
209-210	RENUMMer start line number value.
211-212	CLOADM Z's complement load offset value.
213-214	RENUMMer new start line value.
215	Editor line length — not user available.
274-275	Current value of system TIMER.
277-281	Random number seeds used for RND function.
288	Number of Basic commands.
288-289	Address of list of Basic commands.
291-292	Address of command dispatch table.
293	Number of Basic functions.
294-295	Address of list of Basic functions.
296-297	Address of function dispatch table.
298	Number of disk commands.
299-300	Address of list of disk commands.
301-302	Address of disk command dispatch routine.
303	Number of disk functions.
304-305	Address of list of disk functions.
306-307	Address of disk function dispatch routine.
346	Value of Joystick (1)
347	Value of Joystick (1)
348	Value of Joystick (2)
349	Value of Joystick (3)

Miscellaneous firmware Routines

SysEr — (Dragon 38464, Tandy 41102)

This routine generates the appropriate action for an error code in the R register.

The routine resets the stack, turns the cassette motor and audio off and returns to the Basic command mode. Errors should always be cleared by entering this routine, even if it is initiated by the DCS in the System Error Trapline. Error numbers start at zero which is an NP error, and go up to 52 in steps of 3. DCS errors start at 129 and go up to 186 in steps of five. The error codes are in the following order: NP, SN, RC, OC, FC, OV, CM, UL, SS, DO, O, ID, TM, OS, LS, ST, CH, UF, FO, AO, CM, ID, FM, NO, E, OS, NE.

CmdMode — (Dragon 33649, Tandy 44147)

Finishes the "OK" prompt and returns to the command mode, all return addresses, and subsequent commands on a multi-statement line are lost.

BasicVect1 — (Dragon 33623, Tandy 44321)

Sets up various necessary vectors; one a Basic program has been loaded. It should be followed by a call to BasicVect2.

BasicVect2 — (Dragon 33773, Tandy 44271)

Completes the initialisation process after a Basic program has been loaded. It should be preceded by a call to BasicVect1.

ResetStack — (Dragon 33844, Tandy 44238)

Resets the Basic stack to its initial position, all entries are lost. This routine is used as part of the power-up and error recovery procedures.

NEW basic — (Dragon 33815, Tandy 44312)

Removes the current basic program from memory (if any), resets the basic stack, clears all variables. This routine has exactly the same effect as the NEW command in Basic.

RUN Basic — (Dragon 33861, Tandy 44448)

Runs a basic program in memory. This routine is most often used to autostart basic programs after loading them from tape or disk and calling BasicVect1 and BasicVect2. This routine cannot be called directly from Basic.

Random Number — (Dragon 38798)

Generates an 8 bit random number and places it in location 275.

RESET — (Dragon 46004, Tandy 42999)

Resets the whole machine as if the RESET button had been pressed. The basic program and variables are not affected.

Boot Basic — (Dragon 46098, Tandy 41142)

Resets the Basic interpreter as if the machine had just been powered up and

reset. This has the effect of leaving any program in store and displays the normal sign on message.

Read Joysticks — (Dragon 44449, Tandy 42488)

Updates all the joystick data locations — stored in 346-349.

Uti Basic — (Dragon 36622, Tandy 46948)

List the Basic programs in memory to the Device whose device number is in (D)976 (location 111). The A-register must be zero on entry. This routine can not be called directly from Basic.

Boot Basic004 — (Dragon 46000)

Boots up the 4th version of Basic and goes into RAM mode. The complete routine only exists in the Dragon 64 vROM. A small section of machine code is copied into the cassette buffer. This selects an alternative on board ROM which contains the 64k basic. This is copied into RAM at 48152 onwards and the new basic is entered. Programs are preserved, variables are cleared.

Reset D/A — (Dragon 47628, Tandy 43327)

Puts the value 576 into the D/A converter address.

Write D/A — (Dragon 47630, Tandy 43389)

The A register on entry must contain the data to be placed in the D/A converter, bits 0 and 1 should be clear.

Select J8K — (Dragon 48449, Tandy 43420)

Selects the joystick sources (ports 0, 1, 2, 3) from the A register on entry. This routine writes to CA1 and CA2.

This is the seventh in Brian's series on the Dragon Rom routines. Next month, he will be covering the area of DragonDos Firmware. If you have missed any of the previous issues, they can be obtained from Dragon User, Back Issues, 12-13 Little Newport Street, London WC2H 7PP, at £1.25 each, inclusive of postage, packing and administration charges. Just to remind you of the previous months:
Sept 85 — *Cassette Operating System*
Oct 85 — *COS Firmware Routines*
Nov 85 — *Text Manager Routines*
Dec 85 — *Graphics and Sound*
Jan 86 — *Variables*
Feb 86 — *Assorted Vectors*

Cupid Cupid

More machine code action for the keyboard of Steve Gathercole

THIS GAME is all about Cupid. He has to get his practice so first of all you must shoot your arrows at the moving targets using the Enter key. This is not too bad as Cupid does not move on this first level, but once you have shot 10 arrows you move on to level 2. In this level, Cupid's little wings are getting tired and he keeps falling to the bottom of the screen. You must press the up arrow key to stop him falling and ending the game, but don't go up too high or the game will finish.

After another 10 arrows you move to level 3 where a man and woman appear at the top of the screen. This time instead of a target you will have to hit little hearts — if you hit one then the man will move closer to the woman. The game ends when the man reaches the woman or you use 10 arrows.

For each hit of the target you will score points for the next hit, depending on where you hit the target, in other words, a bull on the first hit will get you more for the next hit on the target. Your hit is also reflected on a large target at the top of the screen. A single half of fame at the end of the game will show your relative score position.

To type in the game proceed as follows. First type in Listing 1, the loader. It is the same as my previous loaders so use it again if you already have it on tape. Run it and you will be asked for the start address (26000). Type this in and Enter. You will then be asked for the finish address (30000). Type this in, then Enter.

Now you must type in the row of hex digits up to, but not including, the "=" sign from Listing 2. Press Enter and then type in the checksum (this is the number after the "=" sign). Press Enter and if all is okay you will see the next address displayed and you carry on like before until the whole of Listing 3 is finished. If you want to type in the listing in small sections, then type in the finish address you want to finish at then save this using COLNAM "CUPID" ,26000,1,26000 where "1" is the address you finished at. Next time you carry on, the start address will be the finish address you used last time — don't forget to COLNAM each part before restarting each time, though.

The whole game is saved using COLNAM "CUPID" ,26000,30000,26000, then once loaded use EXEC 26000 to start. If the game is too much to type in then I will supply a copy for £1.50. Also if you need any help or advice, then don't hesitate to contact me at 18 Hantsdown Estate, Walsley St Andrew, Wakefield, Ganges WF14 7NA. Happy St Valentine's!

```
10 CLS
20 REM HICLOADER - ENTER THE
30 REM STRING OF HEX DIGITS FIRTS
40 REM AND THEN THE CHECKSUM
50 CLEAR 260,27999
60 PRINT"ENTER START ADDRESS":INP
UT START
70 PRINT"ENTER FINISH ADDRESS":IN
PUT FINISH
80 FOR N=START TO FINISH STEP 11
90 PRINTN;" ";
100 TT=0:INPUT A$:Z=0
110 FOR G=1 TO LEN(A$) STEP 2
120 P=VAL("6H"+MID$(A$,G,2))
130 TT=TT+P:POKE (N+Z),P
140 Z=Z+1:NEXT
150 PRINT" = ";
160 INPUT T#
170 IF T# <> HEX$(TT) THEN SOUND 20
,30:PRINT"ERROR - ENTER LINE AGAIN
":GOTO 100
180 NEXT
```

Listing 1



LISTING 2

20000 140077000000000000000000 = 77
20011 000000000000000000000000 = 0
20022 000000000000000000000000 = 0
20033 000000000000000000000000 = 0
20044 000000000000000000000000 = 0
20055 000000000000000000000000 = 0
20066 000000000000000000000000 = 0
20077 000000000000000000000000 = 0
20088 000000000000000000000000 = 0
20099 000000000000000000000000 = 0
20110 0000000000120030F006590 = 39F
20121 660046004600460046004600 = 460
20132 9000001FC00070003000000 = 45C
20143 30300FF0000000007F0007300 = 62F
20154 00000000701F1F0000000000 = 40A
20165 3C3007C10001007010001007 = 320
20176 10F50000000000000000000000 = 425
20187 000000000000000000000000 = 4C4
20198 000000000000000000000000 = 571
20209 F0007FF000110001017F017 = 406
20220 1010F0170100110011001100FF = 300
20231 FF000000200010500F01000 = 549
20242 5030005711C0700F0410FF = 440
20253 0000FC0000100F000100F000 = 423
20264 7C1007000000F200070000 = 203
20275 000000001210000000000000 = 421
20286 900100000000000000000000 = 170
20297 00000100000000000001000 = 90
20308 0710000730000F1100100F = 37F
20319 0007F0000000000000000001 = 673
20330 00F00037C1007000000F200 = 304
20341 070000000000000000000000 = 300
20352 000000000010000000000000 = 300
20363 000000000000100000000000 = 204
20374 F00000000000000000000000 = 700
20385 F0FCF0000000000000000000 = 93C
20396 000000000000000000000000 = 004
20407 F00000000000000000000000 = 700
20418 301000000000000000000000 = 372
20429 202020000000000000000000 = 600
20440 000000000000000000000000 = 304
20451 000000000000000000000000 = 600
20462 000000000000000000000000 = 53C
20473 FC7000000000000000000000 = 60C
20484 000000000000000000000000 = 704
20495 00FCF0000000000000000000 = 70C
20506 F0FCF0000100070000000000 = 500
20517 700000000000000000000000 = 710
20528 F0F000000000000000000000 = 61F
20539 000000000000000000000000 = 503
20550 007001000070000000000000 = 019
20561 70F70F70F70F70F70F70F7 = 001
20572 0770070F300F700100F070F = 70F

20583 000000000000000000000000 = 006
20594 C10000000000000000000000 = 507
20605 0F0FF0000000000000000000 = 700
20616 000000000000000000000000 = 004
20627 C00000000000000000000000 = 620
20638 30F000000000000000000000 = 60C
20649 000000000000000000000000 = 300
20660 000010000000000000000000 = 305
20671 000000000000000000000000 = 30C
20682 F000F001000100010001000 = 001
20693 000001000000000000000000 = 20F
20704 000000000000000000000000 = 310
20715 0010000010F00010F00010 = 303
20726 000010000000000000000000 = 30C
20737 700F0070070077F000000000 = 710
20748 0000FF000000000000000000 = 005
20759 F0000F00000000000000000000 = 450
20770 000000000000000000000000 = 0
20781 000000000000000000000000 = 170
20792 001000000000000000000000 = 500
20803 000000000000000000000000 = 473
20814 300000000000000000000000 = 404
20825 000000000000000000000000 = 52F
20836 300000000000000000000000 = 407
20847 301000000000000000000000 = 450
20858 000010000000000000000000 = 40C
20869 100000000000000000000000 = 30C
20880 001000000000000000000000 = 305
20891 0F0010001000000000000000 = 300
20902 000000010000000000000000 = 422
20913 000000000100000000000000 = 304
20924 000F1F200000000000000000 = 30C
20935 C00000000000000000000000 = 500
20946 20F000101010000000000000 = 400
20957 400100001000000000000000 = 420
20968 F0F221F00000000000000000 = 2C1
20979 300000000000000000000000 = 407
20990 F0F221F00000000000000000 = 200
20001 3000010100100000000000 = 209
20012 300000000000000000000000 = 575
20023 300000000000000000000000 = 400
20034 70FF200011000100000000 = 350
20045 000000000000000000000000 = 704
20056 1F12310F0000000000000000 = 410
20067 300000000000000000000000 = 400
20078 077F20001077F20001100 = 405
20089 010000000000000000000000 = 50F
20100 077F20000000000000000000 = 403
20111 373030000000000000000000 = 520
20122 000000000000000000000000 = 503
20133 000000000000000000000000 = 637
20144 20F000000000000000000000 = 703
20155 000000000000000000000000 = 530
20166 F03000000000000000000000 = 30C
20177 20F000000000000000000000 = 420
20188 000000000000000000000000 = 400

292199	88C98F604668684D818326	=	474	298115	8C9819378888841876D48328	=	398D
292218	88189C8CFD8888928841888	=	362	298226	98C4268848881888887888	=	384
292231	6F88861717FF8C8C192125	=	343	298237	18C61D17FD4117FC0817FC	=	53C
292232	8D18888D7E17FF88888788	=	48F	298468	6C38F8886DCC188887888	=	58F
29243	8F86687588634368886881	=	4F5	298559	18C61E17FD381888781788	=	413
29254	8127488E88888868484887	=	348	29878	6DC8818C61D17FD238886	=	4DF
29265	6D8781842C188848788488	=	388	29881	3488886D688183272CC884	=	288
29276	8888C61F8C888A18888F22	=	343	29882	34881888878A88888C61F17	=	384
29287	17FF4C88818888884888C	=	376	29883	FC8717888A3418888888D18	=	3C8
29288	C88F221F8288888C61F17FF	=	38E	29816	888F728818C61D17FCF617	=	518
29289	3A17F8D888886C38887818C	=	44F	29820	88C7381888888888888888	=	384
29328	8F6D4F18888F88888C8C1E	=	419	29836	3438888D76381F8C888888	=	38C
29331	17FF23C888838888886881	=	44C	29847	F7388C34388888888818127	=	487
29342	882748C888888841CF8888	=	444	29858	13887887815188FF878155	=	483
29353	6C8C3C88818838888818D34	=	328	29869	88888881582888288171388	=	352
29364	48288888886D8F3888288F8D	=	419	29888	684218888D788817C81D17	=	38F
29375	6F38288C8888888888886F4	=	588	29891	FC8138888288F888C3388813	=	512
29386	486C88F78D8C8C14C88C8F7	=	4FC	29892	888843188888788817C61D	=	497
29387	6D8C8C888F388818F8D84F88	=	4F8	29813	17FC8A8888888888888888	=	58F
29488	8D724C878D7238888343688	=	4FC	29824	3438888888888888888888	=	477
29419	8488E784358883436888D72	=	52F	29835	8887FF2217888888888888	=	65F
29438	81172588888868881882818	=	358	29846	2217884C17FC2258268A18	=	3C4
29441	888888818823688888818785	=	3E4	29857	888F228888888888888888	=	349
29482	6817823888888888888888	=	429	29868	FC423888117FC3D84F87888	=	488
29483	4F878D72878D88888888888	=	538	29879	8E1D1E18888F8C888888C1F	=	378
29484	88C1A888818887888D1888	=	498	29888	17FC884F878D6888888888	=	538
29485	684F188888788848C8C1E17	=	3C9	29881	82261417F88817F8888818	=	44E
29486	FE8F388883436888888C183	=	576	29812	8118888F38888888C1F17FC	=	3ED
29587	182788F2C1881827888C17	=	3C8	29813	8C38883438888888888888	=	388
29518	F88881182228188888887417	=	385	29814	8888884F83888888888888	=	38C
29529	F888313F188C8888826F318	=	38E	29815	88F8C88F8FC7888F2288887	=	75A
29548	8888743121188F8D748888	=	437	29816	88F887FF22888888888888	=	568
29551	2E888D8C18C1827888C817	=	388	29817	8C18888888888888888888	=	391
29562	8138188888C818C23281888	=	334	29818	818888C81E17F88F8188818	=	529
29573	8D7417FD7817FD878313F18	=	47C	29819	38821888C847828888888888	=	388
29584	8C888826F21888888743123	=	347	29888	888FFA78888C8788888788C1	=	586
29595	188F8874888888F88D88C1	=	585	29811	C888FFA7888C1C8888F788	=	68F
29686	8C182788881781888888881	=	1F7	29822	1D87188888888888888888	=	38F
29617	86223818888887417FD8417	=	45C	29833	FD8D1288881188888F8888	=	44C
29628	F84717FD84313F188C8888	=	388	29844	EF8C188F18888F22888888C	=	42C
29629	268F1888888743124188C88	=	458	29855	8177888888818C1D18288C	=	389
29658	78888728F88888C18C1827	=	488	29866	C888881C3F8888887843888	=	55E
29661	8888A1788D7288718888D74	=	34E	29877	288888F618888F28881D1E	=	394
29672	17FD1A17FD117FD181788	=	495	29888	88888C1F17F88118888888	=	468
29683	1117FD8C17FD88213F188C	=	38E	29899	8888288888888888888888	=	38F
29684	8888268F18888874312518	=	324	29818	8781288C188825F8888888	=	388
29785	8F8D788C884F846D8C183	=	519	29821	17F844388881288C188F25	=	388
29716	18278821178888C17FD0117	=	389	29832	F488888818888F7288188C	=	474
29727	FD8C188888788888888888	=	533	29843	1D17FD84F8C88882188888F	=	384
29738	8618C61D17FD888887F88F	=	588	29854	8888C61F17F81F31288881	=	32E
29749	6846388847FD1A18888874	=	498	29865	188C8F6725F318888F2388	=	4C7
29768	17FC8C2313F1888888826F5	=	38C	29876	888817FD888888117F88888	=	386
29771	1888887431231888F87417	=	3C9	29887	12A88F88438887888F8888	=	569
29782	F83F88888D188888788818	=	548	29898	48F78D88878D8C8C8881888	=	558
29793	C61E17F888338828F88C018	=	496	29889	68784F878888828F8878D88	=	504
29884	8888F6717FD57C888F74D88	=	5E9	29828	878888878D88888788788	=	508

If you've got a technical question, write to Brian Cudge. Please do not send a SASE as Brian cannot guarantee to answer individual inquiries.

Dragon Answers

Dream Patch

I RECENTLY purchased a Dragon 64 and was disappointed to find that the "Address" assemblies will not work in 64 mode.

Is there any way of patching this program to make use of the extra memory?

G Turner
2 Alder Lane
Great
28 Helms
Lancs

IT IS not possible to "patch" Address to use the extra RAM. However, the solution I use is to copy the Basic into RAM using the program below. This then allows you to use the RAM from 49152 to 65536 for object code and data. The program also copies the first 16 of the cartridge area in case ROM is present, in which case you can use RAM from 57344 onwards.

```
BRCC = 016
LDX = 02756
LOOP STA 0FF0C
LDX X
STA 0FF0F
STD X++
CMP# 027346
BLO LOOP
ANDCC = 028
END
```

Memory Port

I WONDER if you can help me. I have a cartridge I no longer require. I am wondering if it is possible to remove the EPROM in the cartridge and replace it with a RAM chip. If this is possible please could you recommend a RAM chip. Also would I need special software to access the RAM?

O Black
27 Buckingham Road
Belmore
Dorset
BH12 2ED

ALTHOUGH it is certainly possible to add extra RAM to your Dragonette the cartridge port, it is not usually possible to simply replace the system with a RAM chip. The types of system used in Dragon and Coze cartridges also varies so it is not easy to recommend a way of "plugging-in" RAM chips.



The cheapest solution requires a little hardware knowledge, but a minimal of components — just a prototyping cartridge, RAM chip and Address decoder. The RAM would simply be accessed directly from address 49152 onwards.

Breaker Break

EVERYONE talks about the famous F0RKS, to disable the BRK key, but personally I have never come across them. Could you please tell me?

Gray Henderson
29 Woodbury Avenue
Somerset
BA2 2DR

THERE ARE two ways to disable the BREAK key. The first consists of a few poles to the CPU vectors and does not disable BRK as INPUT statements — limiting you to using INPUT. The second method which I favour is rather longer, but works in all situations that I know of. Simply add the three leads (below) to the start of your programs.

```
1. Connect vector 000 to vector 001
2. Connect vector 001 to vector 002
3. Connect vector 002 to vector 003
4. Connect vector 003 to vector 004
5. Connect vector 004 to vector 005
6. Connect vector 005 to vector 006
7. Connect vector 006 to vector 007
8. Connect vector 007 to vector 008
9. Connect vector 008 to vector 009
10. Connect vector 009 to vector 010
11. Connect vector 010 to vector 011
12. Connect vector 011 to vector 012
13. Connect vector 012 to vector 013
14. Connect vector 013 to vector 014
15. Connect vector 014 to vector 015
16. Connect vector 015 to vector 016
17. Connect vector 016 to vector 017
18. Connect vector 017 to vector 018
19. Connect vector 018 to vector 019
20. Connect vector 019 to vector 020
```

Shacking

I RECENTLY purchased a Radio Shack TP-1 Thermal Printer as a companion for my Dragon 64, specifically for the printing of listings. I assumed compatibility would not be a problem, as it was

designed for the Tandy 100-16 and TRS 8 Colour Computer.

I had no trouble in making up a 4-pin DIN to 7-pin DIN cable, with only Data, Status, and Ground connections necessary on each plug. However I ran into my doubts, because after F0RKS:1000, I got the serial port access, the only print-out that I can achieve is a solid block, determined in length by the input string! Direct instruction by Poke=2,000(0) also gave the same single block print-out.

Nigel S Woodberry
28 Windsor Lane
Bournemouth-on-Sea
Somerset
BH2 5L2

I CAN'T see any problem in interfacing this printer with the Dragon 64 as you describe. I think the problem you are having is due to the baud rate being incorrect. The Coze points up a cable with a default rate of 9600 baud for the serial port, and so most Tandy printers expect serial input to be at this speed. The Dragon 64 powers up with a default rate of 1200 baud. I suggest you try the following, which will set the B0332 port to 9600 baud and select 8:
Poke=4FF0F,(P000&0FF0F)
AND=4FF0:00 7:P000:1000,1

High Speed

RECENTLY, I've extended my Dragon from a 32 to a 64 machine. While working in the 64 mode, a problem arose. P002:65495,0 which speeds things up in the 32 mode doesn't seem to have this effect in the 64 mode.

As the Basic is copied in the 64 mode to the RAM, there must be a

new location where I can P002 and get extra speed.

Maybe you could tell me what is the 64 mode's equivalent to the speed P002 in the 32 mode?

Jason Loner
28 Herria Road Street
49132 Patch-Dave
Lancs

THE INFAMOUS "speed-up" poke has been mentioned regularly over the years on this and other pages. P002:65495,0 actually causes the processor to run at double speed when accessing ROM. As the Basic is normally stored in ROM it has the effect of speeding up Basic programs. Machine code programs stored in RAM do not run any faster with this poke.

In 64x mode the Basic is, as you say, stored in RAM and so does not run any faster than normal as the processor is not accessing ROM memory. There is no equivalent "speed-up" poke for RAM I'm afraid.

Printer Problem

I HAVE a Tandy dot matrix printer running with my Dragon and I occasionally notice characters being randomly ejected through-out listings. I have had the printer checked but I'm told there was nothing wrong with it. Could this be a fault with my Dragon's electronics port?

I have a Dragon 64 and DragonDex.

David Jones
Purton
London SE18

THE PROBLEM is actually caused by the interrupt routine. With DragonDex attached the interrupt routine, which runs 50 times a second, is so long that if it occurs between the strobe line being switched (which tells the printer that there is data at the port) then there is time for the printer to take two characters — hence the repeated characters which seem to randomly appear in listings.

The solution is simple — disable the interrupts before sending information to the printer with:
P002:65495,0
P002:65495,0 AND 254
and re-enable them after printing with:
P002:65495,0
P002:65495,0 OR 1

MIKE GERRARD'S ADVENTURE TRAIL

OVER THE last few months I've had lots of letters from readers generously offering to share their adventure successes by giving clues and sometimes complete solutions to games, while at the same time I've been getting letters from new readers and adventurers asking for more hints for beginners. There's never enough space to list all the clues people send me every month, so I've decided to catch up with the backlog this time and have a bumper column of clues and solutions. As always, any information that might be too revealing will be printed backwards to prevent a being seen by anyone who doesn't want to know the answers, though some of the more general clues will be printed ordinarily.

Beverly Lowell of Narnston has solved *Spyge* and offers the following advice:

- 1) Big ugly creatures don't like things threatn at them
- 2) Read numbers carefully
- 3) To kill Darrh needs patience
- 4) Carry as much as you can
- 5) Holding your breath is a very useful exercise

More on *Spyge* from Darren Cash of Birmingham:

- 1) To kill alien: TITA YZZU FWO RHT
- 2) To get in deep pit: DARR TSDM AJER. MALL Grnd Lcse: LHWY PMLU
- 3) To help in killing Darrh, unplug right joystick and use left joystick, trying to keep your left sword crossing over Darrh's.

Justaposition

John Baker of 108 Bishopwood, Buxleia, Bridgend, Mid Glamorgan has written with lots of clues and answers on *Justaposition* which he says he solved in a few sittings but enjoyed very much nevertheless. If anyone's stuck, write to John with a clue, but meanwhile some of the following general advice might help:

- 1) Examine all objects you find
- 2) Most items have a logical use and are only needed once
- 3) Eat regularly or you'll weaken before the end
- 4) Always carry your ID tag
- 5) If night falls then get inside quickly
- 6) Save the game regularly, as several things happen which may catch you out.

John's also sent lots of specific answers to problems, while many readers seem to be having trouble dealing with the floods at

the start of the game. The first drop you meet can be avoided if you don't immediately rush out into the corridor, and afterwards take carefully for its approach to enable you to hide. You should also be able to get over the balcony and out of the first few locations—perhaps an idea might come to you in bed? After that you will then encounter another drop. To deal with this one you will need what might be called a solution.

Darren Doherty of Hayling Island has sent a few tips for the cheats among you. In *Lost in Space*, for protection against the security robots you can add TR(8)=8 at the beginning of Line 1010 in the program. In *Forever of Death* you can get yourself a permanent cloak by adding L(1,10)=50 at the start of Line 1100, and a permanent hammer by adding L(1,27)=50 at the start of Line 1200.

Ice Kingdom

Just to show he can solve adventures the proper way, Jon, Darren sent a few clues for *Ice Kingdom*:

- 1) In the armory: SREG ITH TWOB
NODD DASH LLUP
- 2) To get past the undertaker: RGT STN ROP
- 3) When you meet the small giant: RULO
PEHT MINE VIG

I've received several clues from Darren Royal of London SW15, firstly on *El Dabbers*:

- 1) The coyote is not who he seems to be
- 2) To enter the cave in the canyon: EVA CER AWAH CHYM AGRD
- 3) Found the magic bush? GIV TASN IATH OCTI
- 4) Get a bag? LIO MIT IPID
- 5) Man with machete a problem? ELB BEPE ULWA ORBIT

And secondly on *Time Machine*:

- 1) To get out of the dark opening: RMW DRCH TWR EVEL MAIM EYTH EVEL LLUP
- 2) Generator? RMM AHHT FWTI KAERG
- 3) Police-boy? THE RDM GI

A few months ago in the advantage contact section a reader named J.P. Theopie was asking for help in *Paradise's Tangle*, but unfortunately his address was omitted. R. Tuck of Chippinghams took pity and sent the solutions in to me:

- 1) To get into the water room, go to where the walls have ears and say a word that connects the pictures on the walls that you pass off your way there. (You

almost need a clue to the clue on the one.)

- 2) To give the rabbit the carrots: TBB ARCE EPH. Pals
- 3) To open the sarcophagi: RALLD EPHW MCHP ENNE HUCP

If there was a European Adventure Contest then Rolf Mathiesen of Norway oughtn't stand a good chance of winning, as he's sent me solutions to no less than six adventures. In there nothing else to do in Norway, Rolf? I'm very grateful to him for taking the trouble to do this, the adventures he's covered being *Justaposition*, *Never Mission*, *Caverns of Doom*, *Time Machine*, *Lost in Space* and *Wings of War*. I'll pick a few hints out of each, starting with *Justaposition*, where two readers have already written to me saying they've been having trouble dealing with the Nightmare Droid.

- 1) Nightmare Droid? ARE MAD DITE
SUOS THOI LTHD MBS ETAH
 - 2) Container a problem? EEP FOOS BAW
SULI PDM PEEL STUP
 - 3) To get back across the river: TSW
RDMH ESSH TDSU
 - 4) To disarm the bomb: GULB DERN
EERO DERE ULDS SEAP
- Some of Rolf's clues on *Never Mission*:
- 1) To reach the ledge: RHD RICE RHTI
WYOD HWK AHRH
 - 2) No use for the magnet? TIK SUPP
 - 3) To get into control room: RGD DENT
RGR

In *Caverns of Doom*:

- 1) To open lockhest: NOT CLE KSEH
TBN MAKE
- 2) To move raft over deep water: LLAP
RSTA WOPH HEST AGRH EDNU
KODL
- 3) To get rid of the large bear: RAERT
ANUG EPH

In *Lost in Space*:

- 1) To escape the maze: KWAH WOPH
AFSH OLLD PDM DWP
- 2) To find blue alien: EPT AEDH AEN
HCAW GOCOP MYS ICETI HHTH ESM
- 3) To open security box: MLK NARF SDR
CHWS SAP

For *Mings of War* Rolf has included the following clues:

- 1) To find a car to escape in: SCAL PERP
RAEN STER GARS MPUT
- 2) Key for car? SCAL HTW TDOH SREG
EYF DAF
- 3) How to fix the container? MJLM MJUL
AFOP ARCS DMAM CMH WESU

Steve Gerrard of 126 The Medway, Daren-

by. Northants NN11 4QR has already been mentioned in these pages and repeats his offer to help anyone stuck in *Minotaur* and the *Minotaur*. Steve has also now sent me some more information on the game, including several maps, so I'm going to have to see how best to make use of these. Meanwhile, here's a note of the effects that various spells in the game have:

Water: PMAL SORO TSER
 Mine: GHI TSN DIPP OCSG ERUC
 Asteroid: BARRAC SGANI YTHRA DFIN DITO
 ETOR PCMO SSRE FPOG NAAR DTHS LLK

Celan: ERUSA ERTS DNP
 Nergal: GO FSLR PBD
 Being: SPM LUSE STRA RAUG
 Coven: HTAP SKPO URM
 Ishtar: TSE ROP OTUO YEKH TOTY EMT
 ESRH TEBU

I've had several letters now from adventurers in Israel, where there seem to be plenty of Dragons about, and the latest is from Dudi Marzahn, 1 Hazmat Street, Givat Haasaga 76586, Rehovot, Israel. Dudi is an enthusiastic correspondent, like all the Israeli adventurers I hear from, so if anyone would like to correspond with him (or her, I'm never quite sure with Israeli names!) then I'm sure Dudi would like to hear from you. Particularly if you're having trouble

with *Triskoper*, on which Dudi offers help and a few clues:

- 1) To kill the spider: ELU SPA GENT ENG
- 2) To see the dark room: HCT WASE THW
 SSGR POKA DRUG ELRU DPMH HTHW
 KACD LUP
- 3) Kandas flower? MOOR KRAD GHTIN
 ITT HALP

Triskoper has also been solved, and help is also offered on it, by Eran Tal-Shatan, Eran-Shatan 21 & 3, Simet Itzack-Wely, Tel-Aviv, Israel, and if you're in the mood for setting abroad and perhaps swapping

some software then contact Daniel Mendes, 8 rue de Volvite, 75015 Paris, France. Daniel's interested in getting hold of some of the more recent Dragon adventures and offers in exchange your choice from his collection of over 800 arcade and adventure titles. I didn't realise there was quite that much Dragon software around.

Anyway, I hope you've found this month's bumper crop of clues helpful, and I'm sure you're grateful, as I am, for all the readers who have taken the trouble to send information in. Thanks folks.

Adventure Contact

To help puzzled adventurers further, we are instituting an *Adventurers' Helpline*—simply fill in the coupon below, stating the name of the adventure, your problem and your name and address, and send it to Dragon User *Adventurers' Help*.

Adventure
 Problem

Name
 Address

Mar 86

Adventure Contact

Adventure: *Shenargang*
Problem: I have gold coins, Kinde, Shies, Tish, Gofres and Mallet. What do I do now?

Name: Gwyn Morris
 Address: 15 Wilmam Road, Elgin, Moray, Scotland, IV36 1SY.

Adventure: *The Cuckoo's Nest*
Problem: How to get past the White Rabbit?
Name: Conrad Meyer
 Address: 5 Cotswold Road, Dorchester, DT1 2AH

Adventure: *Shenargang*
Problem: How to cross the deep ravine in the caves and how to find a use for the 128 gold.
Name: Matthew Wells
 Address: 48 Farnside Drive, Banbury, Oxfordshire, Banbury, OX9 3DQ.

Adventure: *Triskoper*
Problem: Cannot get past the second spider or find a command for Inegrate.
Name: David Griffiths
 Address: 16 Sedgemoor Court, Newport, Gwent, NP2 5EQ.

Adventure: *Justaposition*
Problem: Cannot find Monocro to start journey. Have escaped the island and am on the street level.
Name: David Griffiths
 Address: 16 Sedgemoor Court, Newport, Gwent, NP2 5EQ.

Adventure: *Ring of Darkness*
Problem: Everything—I need help!
Name: Paul Vassiliades
 Address: 15 Waverley Drive,

Bellon, Old Yarmouth, Norfolk, NR21 3JU.

Adventure: *The Kat Trilogy*
Problem: How do I go from the mountain onwards? I've got the wand and with the Magic Sorcerer, but I cannot find my way any further.
Name: V. Garrod-Smith
 Address: 4 Beacon Road, Redman, Cornwall, PL31 1AL

Adventure: *Jurassic*
Problem: How do I get into Baron's White's foot, The Pyramid, The Snake, etc?
Name: Nigel Nicola
 Address: 10 Wensley Way, Barton, Great Yarmouth, Norfolk, NR21 5AY.

Adventure: *Mountains of Kat*
Problem: I don't convince the Cartographer to let me go to the second floor of his house.
Name: David Palmer
 Address: Via Molino Di Pescatore 72, Bologna, 40121, Italy.

Adventure: *Justaposition*
Problem: How to get out of the corned city?
Name: Stephen Sherman
 Address: 11 Church Lane, Cambridge, Market Harborough, Leicestershire LE16 8PW.

Adventure: *Synagog*
Problem: Have got light sabre and Mandal transporter, but how do you use it and what do you do in the garden area? Can offer help with *Justaposition*, *Ring of Darkness* and *Return of the*

Ring.
Name: Stuart Beasley
 Address: 3 Stockton Close, Claxton Kings, Chalfonts, Glen.

Adventure: *Justaposition*
Problem: How do you get down to the balcony?
Name: Gertard Pursell
 Address: 35 Marlton Lane, Newton, Swansea.

Adventure: *Shenargang*
Problem: What use is the 12 foot pole and how do you get it into the cave?
Name: Andrew Pann
 Address: 185 Blue Ash, Clock Face, St Helens, Merseyside.

Adventure: *The Cuckoo's Nest*
Problem: What is the two word command which enables you to enter the box and train?
Name: J. R. Claxton
 Address: Sain Coats, Shob Road, Hedling, Norwich, Norfolk NR12 0YS.

Adventure: *Triskoper*
Problem: How do you get past the force field?
Name: Lorna Tinsy
 Address: 14 Malton Close, Ratwell, Northants NN14 2AY.

Adventure: *Madness and the Minotaur*, *Ring of Darkness*, *Lost in Space*
Problem: Everything... all I can do is get killed!
Name: Alan M. Coleman
 Address: 15 Eustace Street, Warrington, Cheshire.
Adventure: *Pirate Adventure*.

Problem: How do you get to Treasure Island from Pirates Island?
Name: Douglas Prid
 Address: 14 Lakenwood, Moxle, St. Harbottle, Midlothian, Scotland EH13 0PT.

Adventure: *Triskoper*
Problem: How do you pass the force field on the garden plane?
Name: Martin Mather
 Address: 3 Ave Bridge Avenue, Sutton Leach, St Helens, Merseyside.

Adventure: *Justaposition*
Problem: Return of the Ring.
Problem: How to find Dead of Screams? How to get away with Endless Emerald?
Name: Graham Raper
 Address: 30 Hough Lane, Hough, Rochdale, Lancs.

Adventure: *Kat Trilogy*
Problem: How do I get past the skull in the cave?
Name: Stuart Jones
 Address: 9 Heath View Crescent, Cardiff, Wales.

Adventure: *Shenargang*
Problem: How to get from the river from the window? Also need help with El Diablero.
Name: Phil Godwin
 Address: 203 Upper Elms Road, Beckenham, Kent.
Adventure: *Justaposition*
Problem: Many and various.
Name: Robert Gassmann
 Address: 35 Ashley Road, Marlow, Bucks HP10 1LQ.

Puzzle it out!

A crossword creator brought to you by C. L. Naylor

PUZZGRID will create the familiar "find the words in the grid" puzzle from your own set of 10 words.

Initially you will be asked to input your 10 words. Naturally with the 10 x 10 grid they must not be longer than 10 letters, and in practice it is better to input the longer words first; the puzzle will be produced in a much shorter time.

After the 10th word has been input you can watch as the computer finds places for all the words in the grid. Finally it fills all the

empty spaces with randomly-chosen letters and the words are listed alongside the puzzle.

You are then given the option of a printout in the form shown in Fig. 1, creating a different puzzle using the same words, or making a completely new puzzle. If you are just doing a one-off puzzle for your pal, then of course he'll have to look away while it is being produced on screen.

The program is relatively simple. The grid is made up from a number of strings which

are then manipulated in Lines 110-280 to fit in your chosen words. A random direction and initial position in the grid are chosen and the current word is temporarily fixed for a fit. If it won't fit, this process is repeated until it does.

The whole routine is then repeated for the next word until all 10 words are in. Lines 290-298 then fill the 'holes' with random letters.

The Printer dump peaks the text screen to produce the final puzzle.

Find the words hidden in the Grid
Across, Down, Diagonally or Backwards

Z E T P E X P E R T	B I P R O S
W E S I T E N D L	S T R I D E
A D G E S T R I D E	C O M P U T E R
H S L K P H S J C V	I N T E R
P I E T T P S E W A	B O X
A X O M N X X Q Q W	P A R T Y
D B I D I N E R N	D I N N E R
L F K E T U P M O C	A B L E
E B F T N E C S E N	S C E N T
E F A R T Y N T N V	R I P E R T

Program Listing

```
100 REM ***** PUZZGRID *****
110 REM ***** C. L. NAYLOR *****
120 REM ***** 1988 *****
130 REM ***** 10 X 10 GRID *****
140 REM ***** 10 WORDS *****
150 REM ***** 10 LETTERS *****
160 REM ***** 10 LETTERS *****
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```


MARCH PUZZLE

Gordon Lee sets the pace — and this month there are 25 copies of Quickbeam's 6809 express to be won

IT IS remarkable to think that it was only just over a decade ago that the first simple pocket calculators were making their first appearance on the domestic market. These early models generally had just the four basic mathematical functions — addition, subtraction, multiplication, and division, and consequently it was sometimes necessary to devise methods of calculating values whose functions were not provided on these machines. The calculation of square roots is a case in point. Readers who are familiar with the classical "pencil and paper" method for the extraction of square roots will appreciate the complexity of this method, and will realise the advantage of an easier method of calculation. Nevertheless, the calculation of square (and cube) roots using just the four basic mathematical functions is still possible. It may be thought that this method has now only a curiosity value, but the actual technique is still applicable in solving problems in computing which do not lend themselves to other, more conventional, methods of solution. This month's competition problem may well be such a case!

But first, the method for finding square roots is as follows:

- 1) Make a rough guess as to what the square root might be.
- 2) Square this value (using the ordinary multiplication function).
- 3) Compare this result with the original number.
- 4) Adjust your guess by a proportional amount to give you a revised value.
- 5) Go to step 2.

By continuing the procedure until the square of the guess is the same as the number whose square root we are trying to find, we arrive at the correct root by a method of approximation. In actual prac-

tice, using a simple calculator, an accuracy of eight significant figures can be obtained in only five or six iterations of the sequence of operations. Mathematically, this is known as a "recursive" method of solution because the method uses each solution as a basis for a further, more accurate, assessment. In effect, the calculator is "learning" by its own mistakes.

This can be translated into the following BASIC program:

```
1 INPUT "ENTER NUMBER :R : GUESS  
= R0"  
2 S = GUESS/GUESS  
3 IF ABS(S-R)/S.00001 THEN PRINT  
THE SQ. RT. OF R = S: GUESS  
4 A=0.000001:R=R2 GUESS=  
R0+ABS(S)-A  
5 GOTO 2
```

The unusual line numbering of this program is so that each line corresponds with the step numbers of the method outlined earlier. If the command PRINT GUESS is added to the end of Line 2, and the program run for a couple of trial examples, it will be noticed that each successive value computed rapidly stabilises towards the correct evaluation of the square root. The final accuracy is dependent on the mathematical accuracy of the computer, but all mathematical operations are subject to this restriction. Curiously, the accuracy of the original guess at the start of the operation is not at all critical. This guess can be wildly out without affecting the final result, the only difference being the number of iterations carried out before the result stabilises. In fact, the program listed dispenses with the need to input a guess as it takes as its first approximation a value of half the number whose root we wish to find.

The creation of such an interactive loop

may provide a method of solving the following problem posed recently by Professor Otto Han to some of his students:

"I have here", announced the professor, "two imaginary spheres, each one a foot in diameter". The professor stood with his arms outstretched, balancing each imaginary sphere on the fingertips of each hand.

"You will realise that the volume occupied by each sphere is a little over half a cubic foot, which will make the total volume of both spheres to be slightly in excess of one cubic foot.

"Now, if I slowly move the spheres closer together there will come a time when the two spheres begin to merge. Unlike real spheres, they do not distort, but like ghosts, they just melt into one another, with the extra volume of the overlapping portion just disappearing.

"You will understand that, if I continue merging the spheres until they are both exactly superimposed I would be left with a single sphere with its original volume of just over half a cubic foot. The second sphere would have vanished.

"What I would like to know is, how far apart are the centres of the spheres when the total combined volume is exactly one cubic foot?"

That was the professor's problem. To solve it you will need to know that the volume of a sphere is given by $V=4/3\pi r^3$, and also that the volume of a spherical segment is given by $V=1/3\pi h(3r^2+h^2)$. Note that if a slice is removed from a sphere by means of a straight cut, the small lens-shaped piece produced is called a spherical segment. In the formula r is the radius of the sphere itself, and h is the height of the segment. If it is laid on its flat cut surface, the height of the curved dome).

Prize

This month we are offering 25 copies of 6809 Express from Quickbeam Software — a sort of cross between Rambo and Thomas the Tank Engine, where you must rescue your captured comrades in your locomotive. Can't be beat ...

Rules

To win your Quickbeam game, you must first solve the answer to the above competition, and demonstrate how you solved it with the aid of your Dragon. Please do not send in a cassette containing your program. Make sure that your name and address are clearly printed on your entry, and make the envelope "March Competition".

tion". Envelopes which do not state which month you are entering for will be disqualified.

As a tie breaker for this month, we're asking you to finish the phrase, "The train now approaching Platform Five ...". It is not more than 12 words. Marks will be given for originality, wit and good spelling.

December Winners

This month winners get a copy of Michael's adventure game Trektron. Congratulations go to Simon Ashby of Seinton, Wilt, H G Woods of Oakdale Gardens, Borekingside, Bore, Essex, Mr E G Haslett of Paxford Road, Egh, Kent, M Ingram of Broadlea Avenue, Leeds, G A

Meenan of New Haw Rd, Addlestone, Surrey, Rachel Schurman of Sandhurst, County Durham, M W Stanton, Bridge Road, Stoneham, Tewkesbury, Northants, J W Davis, Radnorshire Drive, Cheshire, Cheshire.

Inviting tie-break answers (I want to visit a Dark Star because ...) included, "because all my friends have been", "because I want to go where no hacker has gone before", and "my wife told her orange egg is one".

Apologies to anyone who hasn't received their monthly puzzle prize recently — we've been having a spot of bother in that department. If you're one of the unlucky ones, then drop us a line and we'll pop it in the post.

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